

BRYOZOA FROM HERON ISLAND, GREAT BARRIER REEF

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Ryland, J.S. & Hayward, P.J. 1992 06 29: Bryozoa from Heron Island, Great Barrier Reef. *Memoirs of the Queensland Museum* 32(1): 223-301. Brisbane. ISSN 0079-8835.

Eighty-one species of Bryozoa are described from shallow reef habitats around Heron Island, Queensland. Fourteen new species are described: *Puellina decipiens*, *P. egretta*, *P. vulgaris*, *Celleporaria desperabilis*, *Robertsonidra novella*, *Parasmittina galerita*, *P. onychorhyncha*, *P. turbula*, *Pleurocodonellina clavícula*, *Microporella fimbriata*, *Celleporina reginae*, *Rhynchozoon ardeolum*, *R. limatulum* and *R. scopulorum*. Twenty four species are recorded for the first time from Australian waters. □ *Heron Island, Great Barrier Reef, Bryozoa, taxonomy, new species.*

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The coral-associated bryozoan fauna of the Great Barrier Reef (GBR) is undoubtedly very diverse, probably comprising several hundred species. It is, however, poorly known. Thus, in the late 19th century, when the rich bryozoan fauna of Victoria and, to a slightly lesser degree, of New South Wales and South Australia, was being described, the GBR bryozoans were known only by a few specimens from HMS Rattlesnake (Busk, 1852a), from Port Denison and Holbourne Island (Haswell, 1881) and from A.C. Haddon's collections in Torres Strait (Kirkpatrick, 1890a). This lack of study continued through most of the 20th century, with coastal Queensland or GBR bryozoans being described in only a few short papers (Livingstone, 1926; Hastings, 1932; Silén, 1942; Ross, 1974; Ryland, 1974, 1984) and lists (Livingstone, 1927; Dall & Stephenson, 1953; Hall, 1984; Winston, 1986). Consequently, the view prevailed that bryozoans were poorly represented in coral reefs generally and in the GBR particularly (Ryland, 1974). That this must have been erroneous was evident from Maxwell's (1968) study of sediments in which bryozoan fragments, representing a wide diversity of species, formed an important constituent. Recent semi-popular descriptions of the GBR have been given by Bennett (1971), Endean (1982) and Talbot (1984), providing useful background information on the fauna generally but little on the Bryozoa specifically.

The GBR is extensive, stretching some 1900 km from Lady Elliot Reef (24°07'S), slightly south of the Tropic of Capricorn, to the Warrior Reefs and Bramble Cay in the Gulf of Papua (9°09'S). The reefs are dispersed over, and along the edge of, the continental shelf and occupy an area of

some 215,000 km². It is to be expected that the bryozoan fauna will vary with latitude and, most species being essentially subtidal, would be appropriately studied and collected by scuba. The present contribution, in which we describe 81 species, is manifestly preliminary being based on a still incomplete examination of specimens collected intertidally on Heron Island reef, one of the southernmost in the GBR, mainly over a few days in 1972.

Heron Reef is one of 16 comprising the Capricorn Group which, together with four of the Bunker Group, lie between latitudes 23° and 24°S, at the southern end of the GBR. These reefs are separated from Breaksea Spit (Sandy Cape) to the southeast and from the mainland coast in the neighbourhood of Gladstone by Curtis Channel, while the Swain Reefs lie about 150 km northwards across the Capricorn Channel. The 200 m isobath lies some 16-25 km east of the Capricorn Group, whilst the mainland is about 70 km to the southwest. A map of the group, with bathymetry, is given by Jell & Flood (1977) and Mather & Bennett (1984).

Mean water temperatures are 26-27°C in summer dropping to 20-21°C in winter, but temperatures over the reef flat may exceed 32°C or drop to 17°C, or even lower (Endean et al., 1956). Prevailing winds are southeasterly, or from between southeast and east during summer. Low-amplitude ocean swells thus approach predominantly from roughly the southeast. The East Australian Current outside the shelf edge flows polewards but there is little information on the current patterns within the southern GBR. In the central GBR the residual flows are determined by prevailing winds, setting northerly

during periods of steady tradewinds but southerly during light or variable breezes (Wolanski & Pickard, 1985). Releases of surface drifters in the Capricorn Channel suggested a nett southerly movement (Woodhead, 1970). Tides are semi-diurnal, though successive tides frequently differ in height; mean amplitudes are 2m on springs and 1m on neaps. Tidal currents set westerly on the flood, easterly on the ebb.

Heron Island, the cay (23°27'S, 151°55'E), is situated at the leeward (western) end of an egg-shaped lagoonal platform reef (Jell & Flood, 1977), roughly 8.5 by 4km with the long axis orientated ESE-WNW (Fig. 1). At its eastern end, Heron Reef is separated from the smaller Sykes Reef, with which it shares a reefal platform, by a 3km wide channel of about 15m depth (map in Jell & Flood, 1977). The southwestern quarter of Heron Reef is separated by a channel, about 700m wide and 30m deep, from Wistari Reef. The disposition of the two reefs ensures that the western extremity of Heron Reef, and especially the northern aspect of it, is well sheltered from direct impact of the tradewind swells, although waves from the southeast are refracted around the reef. Wave-transported particles are deposited in the vicinity of the cay (Flood, 1974). During the ebb, water from the reef drains in a radial manner (except near the boat channel, see below) until the rim becomes exposed. A shallow lagoon occupies the east-central area of the reef. At spring tides there is an extensive peripheral reef flat, especially at the western end, covered by 0.5m of water or less. The edge of the reef is then accessible from the cay by wading. Access to other parts of the reef edge at low tide, and to the drop off for scuba, must be by boat.

Most descriptions of Heron Island refer more to the cay than to the reef (e.g. Steers, 1938) but brief accounts of the reef have been given by Endean et al. (1956), Cribb (1966), Jell & Flood (1977) and Mather & Bennett (1984). Important man-made features are the boat channel and the cay's western retaining wall. Marine engineering works up to 1980 were summarized by Gourlay & Flood (1981), with particular reference to the stability of the cay, although there have been consequences on the reef flat to the south of the cay. In 1945 a gap was blasted in the reef rim, opposite the northern tip of Wistari Reef, to provide access for small boats. A wreck (still there) was positioned to provide shelter. The gap was extended in 1966-67 to provide a dredged boat channel and harbour. The channel has subsequently been filled with sand mobilized by

cyclones, e.g. 'Emily' (Apr 1972), 'David' (Jan 1976) and 'Simon' (Feb 1980), each time being dredged clear afterwards. The boat channel was extended in 1987-88 (Flood, 1989) and is now associated with a long and substantial jetty. These developments have affected sediment deposition (Gourlay & Flood, 1981), a symptom of a substantially altered flow regime over the southern cay-side flat. Most of the Bryozoa described in this paper were collected from this area in 1972. Water no longer drains radially from the reef here but (1988) flows strongly along the flat towards the channel. The reef flat provided a rich collecting area in 1972 but seemed to have deteriorated markedly by 1988, even before the consequences of the 1986-87 developments (already apparent on water flow) could have affected the living coral framework.

The reef flat extends seawards from the cay to the inner side of the reef rim. At low water springs, away from the boat harbour, water drains through gaps and channels in the rim, but the flat never wholly dries. The inner part of the flat is largely sandy, with patches of coral rubble and some living coral, e.g. *Porites cylindrica*. The outer flat is characterized by living coral, extensive development of crustose coralline algae, and drifts of coral shingle; sand is restricted to small pools and narrow channels. In 1972 the flat at the western end (beyond the boat harbour) was extensively carpeted with a level forest of *Acropora* but shingle has increasingly accumulated since then.

The reef rim is higher than the upper level of live coral on the outer flat. Its surface is cemented with crustose coralline algae, and zoanthids (especially *Palythoa* spp.) are conspicuous. Coral shingle, coral boulders (derived from *Acropora hyacinthus* heads), and sometimes large blocks derived from bommies (plate 30B in Saville-Kent, 1893), accumulate on and just inside the rim. While the rim pavement is devoid of habitats suitable for bryozoans, the boulders constitute the richest intertidal habitat for them.

The reef slope is the sublittoral extension of the reef rim. On the windward (southeastern to southwestern) side of the reef, the upper slope has spur and groove form and the gradient varies from 1 in 20 in the southeast to 1 in 4 southwest of the cay (Jell & Flood, 1977). When accessible in calm weather the coral growing on the spurs would undoubtedly prove a rich habitat for Bryozoa. On the lee side of the reef the spur and groove formation does not develop; rather there is extensive growth of tabular corals, such as *Acropora hyacinthus*. In 1972 some bryozoans

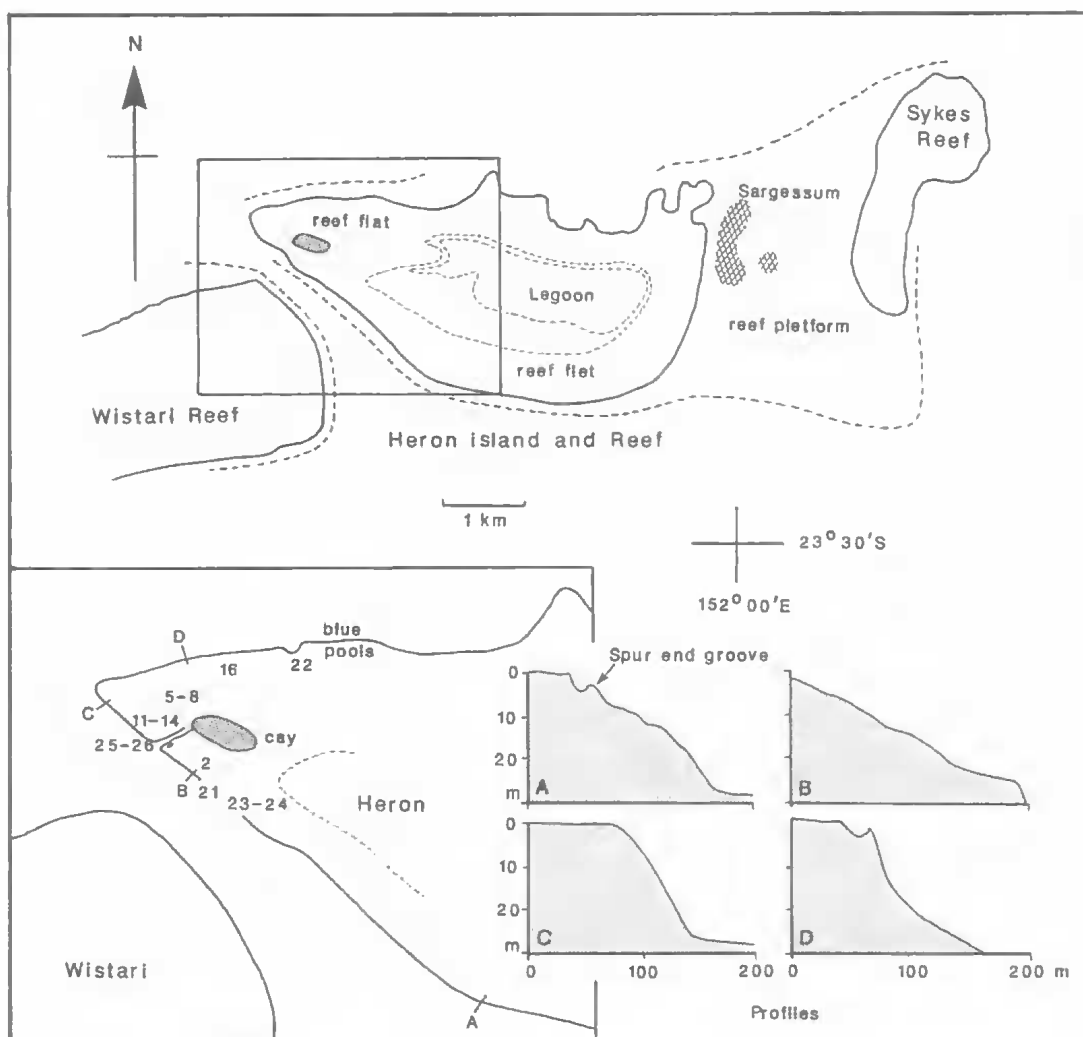


FIG. 1. Heron Island and Reef, showing location of samples. Profiles from Jell & Flood (1977).

were collected by snorkelling and scuba from under such tables, and photographs show the richness there of sessile fauna. It is such tables that, when struck by tropical cyclones, are broken free and hurled onto the edge of the reef. They ultimately settle in the only stable position, with the former attachment facing upwards. The cryptic surface is usually somewhat concave, such that the boulder rests on its rim; irregularities ensure that water circulates through the space, keeping the boulder surface clear of sediment. In this dark, protected habitat ascidians, bryozoans and sponges develop in profusion. Thus the boulders in the Blue Pools area, north of the cay, which were deposited by cyclone 'Emily' (Apr

1972), by 1988 had developed an abundant and colourful sessile fauna of great diversity.

In 1988 occasional pieces of drift *Sargassum* heavily colonized with bryozoans such as *Aetea*, *Crisia*, *Lichenopora* and *Membranipora* and hydroids *Eudendrium* and *Plumularia* were collected on the beach of the cay. At the time it was not known where the *Sargassum* was growing. Subsequently, a bed of *Sargassum* has been located by Lin Baldock and Myriam Preker in 10-15m water in the channel between Heron and Sykes reefs. The species here differ from those of boulders and discovery of the *Sargassum* bed should greatly benefit future studies on the Bryozoa.

MATERIALS

With the exception of two species of *Bugula* found on boulders near Blue Pools in 1988, the bryozoans described in this paper are from 14 of the 28 samples obtained by JSR in 1972. These are identified by sample numbers (Fig. 1) as follows:

2. 9 Apr, 1972. On the reef flat south of the cay. Bryozoa were collected on pieces chipped off tabular *Acropora*, in situ, or from dislodged heads resting on the sand. Bryozoans were present on under surfaces, though rarely abundant, and less common than sponges.
5. 11 Apr, 1972. On the reef flat WNW of the cay. Flat plates of coral, the outer parts spread as horizontal laminae, the inner were convoluted, forming recesses and clefts sheltering *Margaretta*, lace corals (Phidoloporidae), and cellularines.
6. 11 Apr, 1972. Near 5 on the reef flat WNW of the cay. Plaies of *Echinopora* with encrusting bryozoans on the lower surface.
8. 11 Apr, 1972. Near 5 and 6. The flat here was a level platform of abraded *Acropora* with a maze of cavities underneath, and coral 'fingers' rising from the surface. The encrusting fauna seemed poorer than under individual tables.
11. 12 Apr, 1972. On the reef flat west of the cay, to the north of the boat channel. Part of a well-developed *Acropora* head which had tipped when stepped on. The outer parts were coated with a thin, filmy prussian blue sponge. Several *Reteporella graeffei* and inerusting species were present.
12. 12 Apr, 1972. On the reef flat, near 11. Below the actively growing *Acropora* head, supported by a slender pedestal, was a layer representing an earlier growth level, 3-5cm thick, with sediment lying on its upper surface. The lower surface was white, lacking encrusting coralline algae, but bearing *Tubastrea*, sponges, *Filigrana*, a brachiopod, and bryozoans. Below this was coral rubble.
14. 12 Apr, 1972. Near 12. Pieces broken from a large *Acropora* head which had become free and turned upside down, though continuing to grow.
16. 13 Apr, 1972. Crest to the west of the cleft in the reef edge, northeast of the cay. The crest here was strewn with boulders deposited (or redistributed) by cyclone 'Emily' (1-2 Apr). The sessile fauna on the *Acropora* was protected by the knobby surface of the pedestal. Fragments of typically subtidal erect Bryozoa, such as *Triphyllozoon* and violet *Iodictyum*, were also picked up here. (These boulders were examined in 1988, having been on the reef for 16 years. The fauna is still being studied).
21. 14 Apr, 1972. Reef crest south of the cay. Most of the flat approaching the crest at this point was level, easy to walk on, rather than being a forest of heads. Several coral boulders derived from *Acropora* heads were present. The living coral of the crest tended to form layers (almost shelves). While water on the flat appeared to ebb over the coral, on the crest it noticeably percolated through the coral. The space matrix would seem ideal for bryozoans being fairly dark and with long periods of water flow. The coral heads typically, though not invariably, displayed a lower surface zonation, with the peripheral fingers covered with lithothamnion and the centre region white, with *Filigrana* tubes, sponges, compound ascidians and Bryozoa. The sample was a piece of boulder showing a coral/bryozoan interface.
22. 15 Apr, 1972. Reef crest at the cleft, northeast of the cay. The crest here is more complex than at 21. There is the actual edge, marked by surf, then a moat; the coral then rises onto the crest which merges into the zone of coral boulders and rubble (see profile D, fig. 1, from Jell & Flood, 1977). Along the crest coral was dying back, apparently because cyclone 'Emily' had altered the drainage pattern, leaving the coral heads dry and dying; or live coral had been flattened by pounding with the *Acropora* boulders produced by the cyclone. Sample was from these boulders, though most *Iodictyum* fragments were unattached.
23. 16 Apr, 1972. Reef crest south of the cay; collection made by turning boulders. Tide poor; reef edge not exposed; water running off the reef as a sheet.
24. 17 Apr, 1972. Near 23; from well-incrusted boulders.
25. 18 Apr, 1972. Collection from 4.5-9m at binnacle made by D.R. Robertson. Included *Bugula dentata*, *Nellia simplex* and Phidoloporidae.
26. 18 Apr, 1972. Near 25, about 3m depth on the slope.

Holotypes and paratypes of the new species described here are in the Queensland Museum.

ACKNOWLEDGEMENTS

We are grateful to the Nuffield Foundation for the provision of a Travelling Fellowship to JSR in 1971/72, to the Royal Society for a travel grant in 1988, and to the Australian Biological Resources Survey for generous financial support for our research. Thanks are also due to the Director of the Heron Island Research Station, Dr Ian Lawn, and to Miriam Preker, who kindly supplied data on the distribution of *Sargassum*, and Dr P.G. Flood for freely given advice and information on the physical environment of Heron Island. P.J. Chimonides and Mary E Spencer-Jones (Natural History Museum, London) were most helpful in facilitating the loan of type specimens. Dr M.R. Fordy (School of Biological Sciences, University of Wales, Swansea) is especially thanked for his valued expertise in scanning electron microscopy.

SYSTEMATIC ACCOUNTS

The taxonomic order adopted here follows that established by Gordon (1984, 1986, 1989b). Taxonomic diagnoses are provided at family and genus level, and the species descriptions and measurements are based on Heron Island specimens. The synonymies given for each species are deliberately selective, being limited to the original description and the most useful, recent accounts. Unverified synonymies have been avoided. The occurrence of each species at Heron Island, and its wider geographical distribution, are briefly noted. It is intended that a more precise account of the ecological distribution of the bryozoan fauna will be prepared after the completion of the present, continuing research project.

Class STENOLAEMATA Borg, 1926
Order CYCLOSTOMIDA Busk, 1852a
Family LICHENOPORIDAE Smitt, 1867

Colony encrusting, regularly circular or oval, occasionally developing as a cylinder around erect substrata; concave or domed, nodular or mamillate, often lobed; bordered by a peripheral lamina of common basal wall. Autozooids radiating from centre of colony, sometimes in irregular quincuncial series, more usually in connate, uniserial or multiserial rows. Extrazoooidal space between zooid rows divided by calcified struts, defining polygonal spaces referred to as alveoli. Brood chambers originating in centre of colony,

with lobes extending between zooid rows, roofed by finely granular calcification; oöeciostomes situated at edges of brood chamber, between zooid rows.

Lichenopora Defrance, 1823

With the characters of the family.

Type species: *Lichenopora turbinata* Defrance, 1823.

Lichenopora novaezelandiae (Busk)
(Fig. 2a,b)

Discoporella novaezelandiae Busk, 1875: 32, pl. 30, fig. 2.

Lichenopora novaezelandiae: Brood, 1976: 299, figs 17A-C (not figs 17G-I, = *Disoporella sibogae* Boig); Hayward & Cook, 1983: 137.

DESCRIPTION

L. novaezelandiae, as described and figured by Busk (1875) and Harmer (1915), has uniserial zooid rows and a simple, rounded oöeciostome. Brood (1976) appears to have confused his figures with those of *Disoporella sibogae*, a superficially similar species in which the zooid rows are always biserial. Colonies are typically oval and domed, and may reach 10 mm in length. This species is probably quite common in shallow reef environments, but it is generally inconspicuous. Several large colonies were present in the interstices of *Acropora* in sample 2.

DISTRIBUTION

It is distributed throughout the western Pacific, from New Zealand to Japan, and westwards to the east coast of Africa.

Class GYMNOLEAMATA Allman, 1856
Order CHEILOSTOMIDA Busk, 1852a
Suborder ANASCINA Levinsen, 1909
Superfamily MEMBRANIPOROIDEA Busk, 1854

Family CALLOPORIDAE Norman, 1903

Colony encrusting, forming coherent or disjunct sheets, or reticulate to uniserial runners; or erect, developing bilaminar plates or arborescent, viculariiform growths, attached by an encrusting base. Frontal wall of autozooids with extensive membrane, sometimes overarched by spines but always conspicuous; gymnocrystal and/or cryptocystal calcification usually present, often well developed. Spines present or absent.

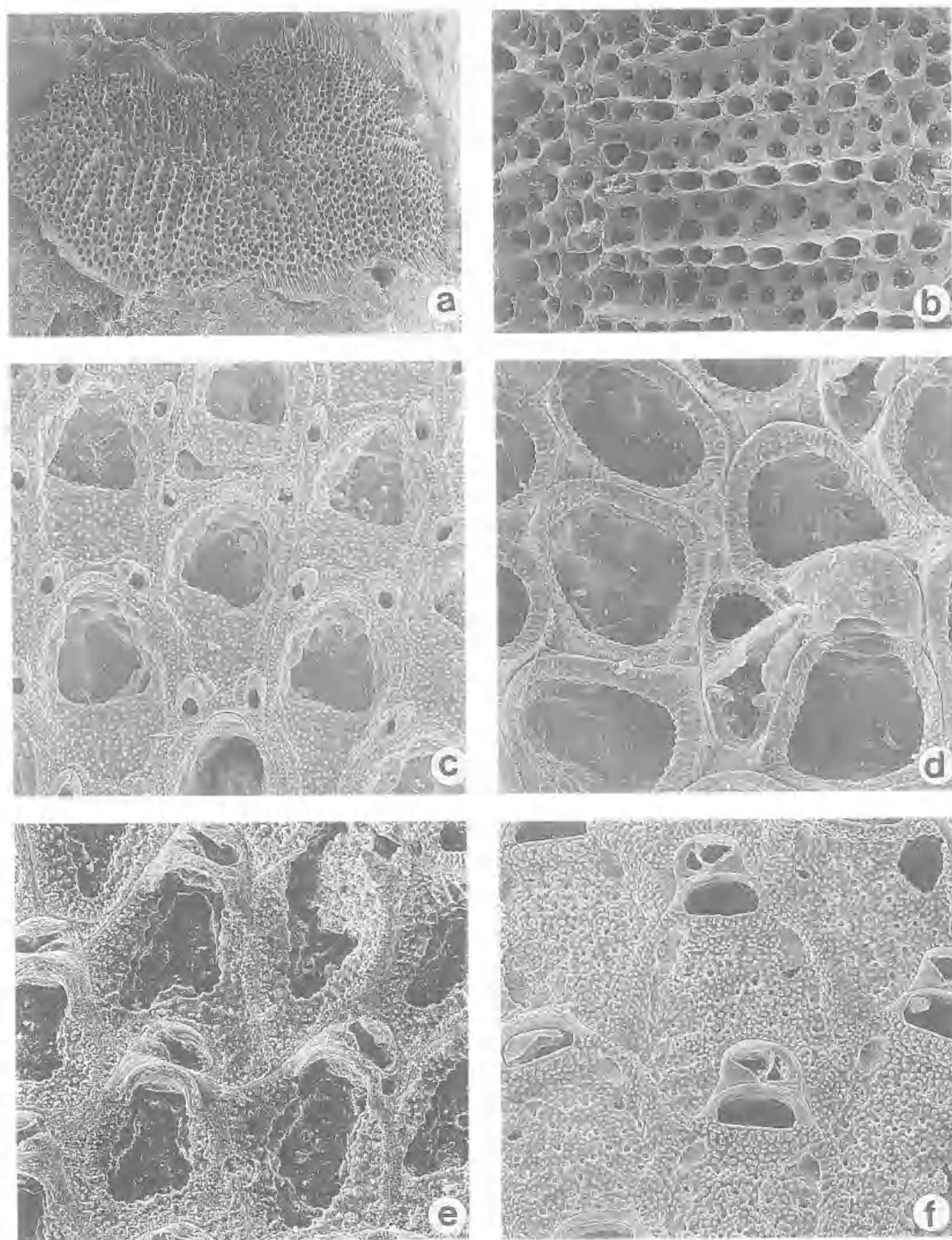


FIG. 2. a,b, *Lichenopora novaezelandiae*; a, whole colony, $\times 9$; b, detail showing ooeciostome between two zooid rows, $\times 30$. c, *Antropora granulifera*, $\times 80$. d, *Parellisina curvirostris*, $\times 60$. e, *Cranosina coronata*, $\times 50$. f, *Micropora variperforata*, $\times 75$.

Avicularia adventitious and/or vicarious, sometimes lacking. Ovicells generally present, hyperstomial, or partly immersed, reduced. Vertical walls with large basal pore chambers, or mural septula.

Antopora Norman, 1903

Colony encrusting. Autozooids with well developed cryptocyst; gymnocyst negligible or absent. No spines. Avicularia interzooidal, small, sometimes lacking. Ovicell endozooidal, its presence indicated by a slight thickening at the distal end of the autozooid. Basal pore chambers present.

Type species: *Membranipora granulifera* Hincks, 1880b.

Antopora granulifera (Hincks)
(Fig. 2c)

Membranipora granulifera Hincks, 1880b: 72, pl. 9, fig. 4.

Antopora granulifera: Harmer, 1926: 232, pl. 14, figs 11-14; Cook 1968a: 138, text-fig. 9.

DESCRIPTION

Colony forming flat, unilaminar sheets. Autozooids irregularly oval to hexagonal, each with a raised crenellated rim; $0.4-0.5 \times 0.2-0.3$ mm. Cryptocyst occupying about half total autozooid length, flat or slightly concave, coarsely beaded; opesia subtriangular. At the distal end of each autozooid is a pair (rarely one) of small, interzooidal avicularia, each budded from a distolateral pore chamber; rostrum acute to frontal plane, directed distally or disto-medially, 0.07 mm long, with a short triangular mandible.

DISTRIBUTION

Antopora granulifera is possibly circumtropical in distribution. It has been reported from Madeira, West Africa, Sri Lanka, Indonesia and the tropical eastern Pacific, but has not been recorded previously from the Great Barrier Reef. It was found at two stations on Heron Island (samples 2 and 16), on the reef flat to the south of the cay, and on the reef edge to the northeast.

Parellisina Osburn, 1940

Colony encrusting. Autozooid with narrow cryptocystal rim, and minimal area of gymnocyst. Spines reduced or absent. Avicularia vicarious, large, each associated with a small kenozooid.

Ovicell prominent, hyperstomial. Basal pore chambers present.

Type species: *Membranipora curvirostris* Hincks, 1862.

Parellisina curvirostris (Hincks)
(Fig. 2d)

Membranipora curvirostris Hincks, 1862: 29, 1880a: 153, pl. 20, figs 5,6.

Ellisina curvirostris: Harmer, 1926: 228, pl. 14, fig. 7.

Parellisina curvirostris: Cook, 1968a: 156, text-fig. 16; Winston, 1984: 7, fig. 14; Winston & Heimberg, 1986: 6, figs 7,8.

DESCRIPTION

Colony forming small, unilaminar patches. Autozooids broadly oval or pear-shaped, commonly 0.5×0.3 mm, the extensive frontal membrane bordered by a raised mural rim; a pair of delicate, evanescent, distal oral spines present in early ontogeny. Avicularia frequent; distinctive: rostrum acute to frontal plane, 0.25 mm long, laterally curved; associated with a kenozooidal polymorph. with a rounded opesia, visible distal to the rostrum. Ovicell relatively small, the ectoecium membranous frontally, exposing granular entoecium.

DISTRIBUTION

This familiar species has a pantropical distribution, ranging into temperate regions in the north-east Atlantic and perhaps elsewhere. It forms small, and generally inconspicuous, colonies on hard substrata, particularly biogenic carbonates. It is common at Heron Island, occurring in seven of the sample stations reported here.

Crassimarginatella Canu, 1900

Colony encrusting; or erect, attached by an encrusting base, bilaminar or vinculariiform. Autozooids with extensive opesia, bordered by a narrow, granular cryptocyst; gymnocyst variably developed. Spines present or absent. Avicularia vicarious. Ovicell prominent, hyperstomial, or small and cap-like. Vertical walls with basal pore chambers or mural septula.

Type species: *Membranipora crassimarginata* Hincks, 1880b.

Subgenus Corbulella Gordon, 1984

Autozooids with well developed gymnocyst, and numerous marginal spines. Avicularia

vicarious, with proximal opesia bordered by spines. Ovicell prominent, hyperstomial, with a broad frontal fenestra.

Type species: *Membranipora corbula* Hincks, 1880c.

***Crassimarginatella (Corbulella) corbula*
(Hincks) (Fig. 3)**

Membranipora corbula Hincks, 1880c: 378, pl. 17, fig. 6.

Crassimarginatella (Corbulella) corbula: Gordon, 1984: 29, pl. 3, figs D,E; 1986: 32, pl. 5, fig. A.

DESCRIPTION

Colony encrusting, forming a small, flat, unilaminar sheet. Autozooids oval, 0.5×0.35 mm, with large oval opesia, a narrow, granular cryptocyst and a reduced, smooth gymnocyst. Twelve to 18 pairs of spines distributed around the opesia, the distal one or two pairs stout, erect, the rest thin, incurved over the frontal membrane. Ovicell spherical, with a transversely oval frontal fenestra, its distal edge often developing a short umbo. Avicularium slightly larger than autozooids, its distal half comprising a raised, smooth-edged rostrum, supporting a semielliptical mandible; proximal half consisting of a shortened opesia bordered by three or four pairs of curved spines.

DISTRIBUTION

This species is widely distributed in the western Pacific from Japan to New Zealand. A single colony was present in sample 16, from the reef edge northeast of the cay.

***Cranosina* Canu & Bassler, 1933**

Colony encrusting. Frontal membrane of autozoid underlain by a broad, peripheral cryptocyst; gymnocyst absent. No spines. Avicularia interzoidial, typically one budded from each autozoid; mandible setiform. Ovicell reduced, endozoidial, or lacking. Large basal pore-chambers present.

Type species: *Membranipora coronata* Hincks, 1881a.

***Cranosina coronata* (Hincks)
(Fig. 2e)**

Membranipora coronata Hincks, 1881a: 147, pl. 10, fig. 1.

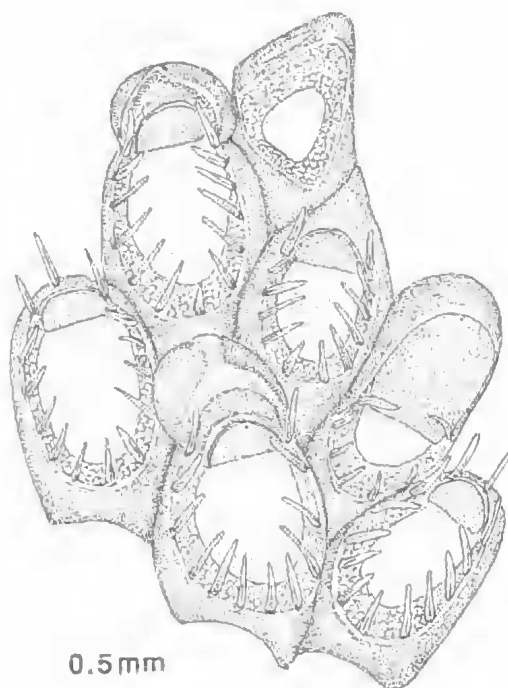


FIG. 3. *Crassimarginatella (Corbulella) corbula*.

Cranosina coronata: Winston & Heimberg, 1986: 6, figs 3-6; Hayward, 1988: 281.

DESCRIPTION

Colony forming flat, unilaminar sheets. Autozooids irregularly oval to hexagonal, separated by distinct grooves; $0.65\text{--}0.7 \times c.0.4$ mm. Cryptocyst coarsely beaded, the beads aligned in ridges, directed medially and imparting a crenulate edge to the cryptocyst. Distal end of autozoid raised, with a hood-like border of smooth, gymnocystal calcification supporting the operculum. Avicularium developed from the distal pore chamber of each autozoid, its cystid not clearly distinguishable from the distal wall of the autozoid; rostrum transversely orientated, at a slight angle to the frontal plane, constricted medially, its distal end flared; mandible setiform, very finely toothed, about 0.4 mm long.

DISTRIBUTION

A single small colony of this species was present in sample 16. It is distributed throughout the Indo-West-Pacific region, from the Philippines to Sri Lanka and Mauritius. Also reported

from Puerto Rico (Osburn, 1940) and Venezuela (Winston, 1986).

Family QUADRICELLARIIDAE Gordon, 1984

Colony erect, branching, jointed. Autozooids elongate, opesia extensive; cryptocyst moderately to well developed; gymnocyst reduced. Avicularia adventitious, or absent. Ovicells present or absent. Ancestrula resembling later autozooids, but with a tubular proximal portion rising from an uncalcified stem.

Nellia Busk, 1852b

Colony erect, branching, jointed; internodes square-sectioned, consisting of four longitudinal series of autozooids, arranged in alternating, back-to-back pairs. Autozooids with well-developed gymnocyst; opesia with broad, proximal border of cryptocyst and surrounded by raised mural rim. No spines. Avicularia adventitious. Ovicells small, partly immersed.

Type species: *Nellia oculata* Busk, 1852h.

Nellia tenuis Harmer
(Fig. 10c)

Nellia tenuis Harmer, 1926: 245, pl. 14, figs 16-17.

Nellia tenuis Hayward, 1988: 286, pl. 1, fig. a; Gordon, 1989a: 450, fig. 3.

DESCRIPTION

Colony delicate, inconspicuous, formed from internodes 1-4mm long, 0.25mm wide; dividing dichotomously at infrequent intervals, most often developing simply an undivided series of two or three internodes. Joints between internodes consisting of slender, cuticular tubes; each internode finely tapered proximally. Autozooids about 0.5 × 0.25mm, the narrow, oval opesia comprising about three-fifths of total autozooid length. A pair of avicularia at the distal end of each autozooid; rostra pointed, hooked, at right angles to long axis of internode.

DISTRIBUTION

Nellia tenuis is probably quite common in shallow reefal habitats. At Heron Island, it was present in samples 14 and 24, from the reef flat west of the cay, and the reef crest to the south. Harmer (1926) had fragmentary specimens from three localities in the Indo-Malaysian region, and listed a fourth from the South China Sea. Ryland (1984) illustrated specimens from Fiji. It was

abundant on Mauritian reefs, as part of a bryozoan sward developed beneath coral boulders (Hayward, 1988).

Superfamily BUGULOIDEA Gray, 1848
Family BUGULIDAE Gray, 1848

Colony erect and branched, unjointed, unilaminar, attached by rhizoids. Zooids long, parallel-sided, with almost all of the frontal surface membranous; lateral walls lightly calcified; marginal spines usually present. Pedunculate 'bird's head' avicularia characteristically present. Ovicells independent and hyperstomial, with the ectooecium membranous.

Bugula Oken, 1815

Colony erect, growing from an upright ancestrula, branching; attached by rhizoids which issue from frontal, lateral and basal surfaces of the autozooids. The latter arranged in two or more series, alternating; boat-shaped, with the proximal end forked and the distal end of the next lowest zooid wedged into the fork, extending beyond it on the frontal side; with a row of uniporous, or one to two multiporous, septula. Seen from the front the zooids are usually truncate distally and slightly attenuate proximally. Basal and lateral walls lightly calcified, the membrane occupying most of the front; orifice closed by a sphincter and no operculum can be distinguished. One or more spines may be present, usually confined to the distal angles of the zooid. In most species, a pedunculate avicularium shaped like a bird's head present on the side of all or many zooids. Ovicell hyperstomial, with calcified endooecium and membranous ectooecium; typically globular, but sometimes reduced to a hemisphere or less, closed by the inner vesicle which sometimes forms the major part of the ovicell.

In biserial species the arrangement of zooids at a bifurcation usually conforms to one of three patterns, originally described by Harmer (1923) as types 3, 4 and 5. The bifurcations are best studied from the basal side in stained and cleared preparations, but can generally be observed in a piece of a clean specimen viewed by transmitted light. The pattern of consecutive bifurcations is laterally reversed, so that the bifurcations immediately above and below any given one are mirror images of it. For descriptive purposes the zooids involved in the bifurcation are distinguished by letters (Fig. 4). The first zooid from which two

zooids are budded is referred to as A, the one beside it (which also buds two) as B. The outer zooids above A and B are C and D respectively while the inner zooids are E and F. In bifurcations of type 3 the axil is formed by zooids E and F. In type 4 the axil is formed by F and G (G being immediately distal to E in the same series). Zooid E is thus excluded from the axil, and the proximal part of G connects with F. In type 5 the enclosing process has been further extended so that both E and F are completely surrounded, and the axil is formed by G and H (Fig. 4). It should be noted, however, that the connecting portion between G and H may be very slender. In a further development of the enclosing process, several zooids may be surrounded; the branch then becomes quadriseriate below the bifurcations.

Type species: *Sertularia neritina* Linnaeus, 1758.

***Bugula dentata* (Lamouroux)
(Fig. 4)**

Acamarchis dentata Lamouroux, 1816: 135, pl. 3, figs 3a,b.

Bugula dentata: Busk, 1852b: 46, pl. 35, figs 1-5; Harmer, 1926: 439 (cum syn.), pl. 30, figs. 5,6; pl. 32, figs 21-25; Ryland 1974: 343; 1984: 68, fig. 4; Winston, 1986: 6.

Bugula sp.: Doak, 1971, colour plate 31 and rear cover; Coleman, 1977: 80 (colour plate).

DESCRIPTION

Colony tufted, not on a stalk, with some tendency to spiralling of branches; to 10cm. Branches narrow, of uniform width, the zooids biserial. Bifurcations of type 5, i.e., with two zooids wholly enclosed, most obvious in basal view. Zooids 0.6×0.25 mm (basal), in Heron Island material. Opesia occupying three-fifths or more of the frontal surface; the external margin of the zooid in-rolling proximally, narrowing the opesia. Inner distal angle with one spine, outer with two, sometimes long, and jointed at the base; a third outer spine some way below the other two. The spines of equal size on both sides of the branch, or the outer ones (with reference to the proximal bifurcation) much larger. Avicularia of two kinds: ordinary marginal avicularia attached about two-thirds way down the zooid, a little above or just below the vortex of the opesia; giant avicularia present or not. Ordinary avicularia about 0.2mm in length, a little less than the width of the bearing zooid at the point of attachment; dorsal profile of rostrum straight, its tip abruptly hooked (rectangular). Giant avicularia, when present, most often replacing normal avicularia on the two outer zooids (C, D) at bifurcations; much longer than the width of the bearing zooid; its entire upper profile convex, the rostral tip sometimes with lateral cusps; the mandible clavate, with a weak terminal point (Harmer, 1926, pl. 32, figs 21,23, 25). Ovicells globose, attached somewhat obliquely over the inner distal angle (Harmer, 1926,

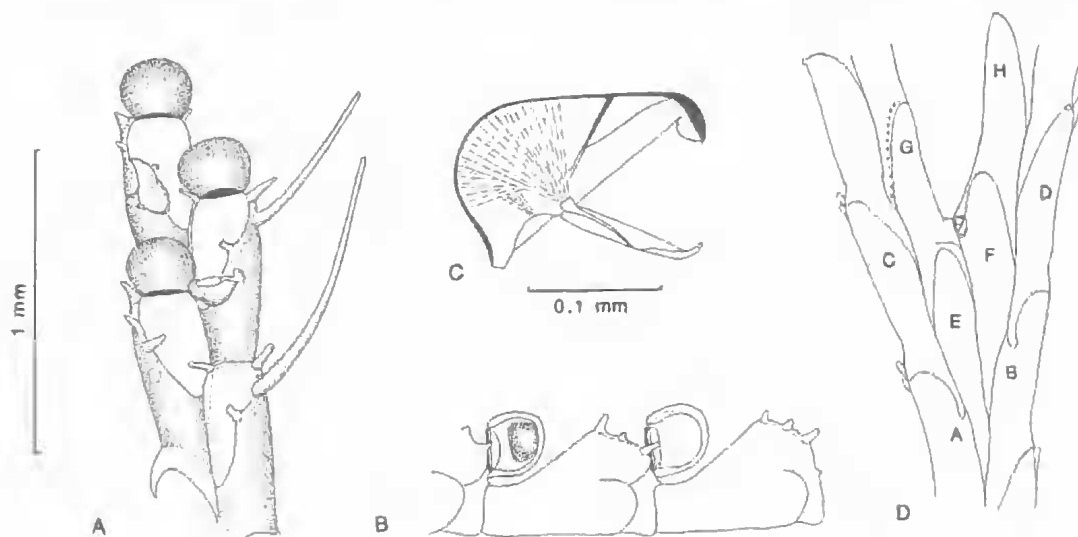


FIG. 4. *Bugula dentata*. A, Group of autozooids, with ovicells and avicularia. B, Autozooids in lateral view. C, Avicularium. D, Basal view of a dichotomy.

pl. 32, fig. 21) or wider than long, occupying the full width of the distal margin; surface calcification rippled; the closing membrane cuticularized.

REMARKS

The living colony is deep bottle green in colour, though acquiring a bluish sheen in flash photographs (Doak, 1971, pl. 31, & back cover; Coleman, 1977:80); on preservation the colour disappears leaving the colony of leaden appearance. The variability of this species was mentioned by Ryland (1974). In particular, the obliquely orientated ovicells, emphasized as diagnostic by Harmer (1926), seem to have been observed only in material from Indonesia. Giant avicularia have been recorded only from Singapore, the Banda Sea and Torres Strait. The normal, marginal avicularia are attached about two-thirds way down the outer wall of the zooid but, since the opesiaae vary in length, the avicularian attachment may be either lateral or proximal relative to the opesia. The unusual and distinctively cuticularized oocial closure, unremarked until 1974, characterizes all specimens from Madeira to New Zealand.

DISTRIBUTION

Widely distributed in the tropics and subtropics from Madeira and Cape Verde Is., to southern Africa, Indian Ocean (Amirante Island), Indonesia, Japan, Lifu, and northern New Zealand. In Australia, Coleman (1977) gives the depth range as 2-40 m; the habitat as rocky reefs, coral reefs and wharf piles; and its distribution to all States except N.T.

Bugula vectifera Harmer (Fig. 5)

Bugula vectifera Harmer, 1926: 442, pl. 31, figs 1-6.

DESCRIPTION

Colony a loose spreading tuft, delicate, pale translucent straw-brown; to about 15mm in height; anchored proximally by rhizoids; the branches also attached to the substratum by intermittent rhizoids. Branches with zooids in two series, with type 4 bifurcations (Fig. 5D). Zooids weakly calcified; elongate, narrowed proximally, 0.55 (SD 0.03) $\times$ 0.13 (SD 0.01) mm basally; opesia occupying about three-quarters of the frontal surface. No marginal spines. Avicularia attached on pedicels, proximal to the opesia,

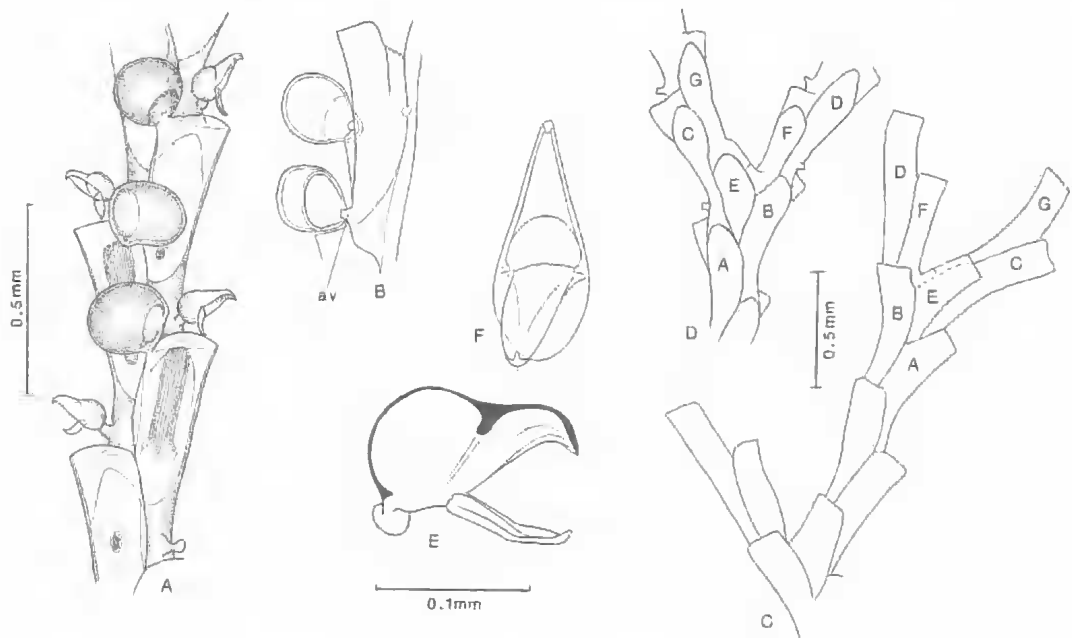


FIG. 5. *Bugula vectifera*. A, Group of autozooids, with ovicells and avicularia. B, Autozooids in lateral view, showing attachment of ovicells and avicularia. C, Part of a branch in basal view. D, A dichotomy in basal view. E, Avicularium. F, Palatal view of avicularium.

close to the distal margin of the preceding zooid; their length approximately equal to the terminal width of the preceding zooid; rostrum as long as the head, its tip sharply downcurved (Fig. 5E); width about the same as in *B. subglobosa* but, the rostrum being longer, lacking the swollen appearance of that species (Fig. 5F, cf. Fig. 6D). Ovicells prominent, a little longer than broad, narrowly attached to the inner distal angle of the bearing zooid (Fig. 5A,B), transversely orientated; the opening directed downwards and across the end of the bearing zooid, invisible from most viewpoints, close to the avicularium of the succeeding zooid. Embryos pale mahogany or pale purple-brown. Tentacle number 17-18, 'about 12' in Harmer's material.

DISCUSSION

Some differences are apparent between the Heron Island material and that described by Harmer. These probably relate mainly to the narrowness of the zooids in the Indonesian specimens (0.53 (SD 0.05) $\times$ 0.085 (SD 0.01) mm in British Museum specimen 1928.3.6.287, Borneo Bank), with 'their frontal surfaces sloping obliquely away from the median raised part of the branch'. In the Heron Island specimens this is slightly evident in the proximal part of the colony, but not elsewhere where the distal angles of the zooids tend to be raised well above the surface of the next distal zooid. Zooids tend to be uniserial proximally, though not to the extent described by Harmer in one of the Borneo Bank specimens; neither is there any longitudinal thickening here. Indeed, the habit of the colonies is semi-repent (*Scrupocellaria*-like) rather than arborescent, with a supporting stem. In other respects the agreement between the two groups of specimens is very close.

OCCURRENCE

Found, usually with *B. subglobosa*, among the under fauna of several boulders in the tract at Blue Pools, 27-31 Jul 1988. First record from Australia.

DISTRIBUTION

Great Barrier Reef, Java, Borneo Bank (Strait of Makassar), eastern Honshu, Japan (Harmer, 1926).

Bugula subglobosa Harmer (Fig. 6)

Bugula subglobosa Harmer, 1926: 444, pl. 32, figs 15-18.

DESCRIPTION

Colony a loose spreading tuft, attached proximally by rhizoids, delicate, pale straw coloured, up to about 15mm; the branches also attached to the substratum by intermittent rhizoids. Branches with zooids in two series, with type 4 bifurcations (Fig. 6B). Zooids elongate, narrowing proximally, 0.59 (SD 0.04) $\times$ 0.13 (SD 0.01) mm basally; weakly calcified. Opesia occupying about three-quarters of the frontal surface. No marginal spines. Avicularia attached on pedicels, proximal to the opesia, almost under the distal edge of the preceding zooid; short (much shorter than the terminal width of the preceding zooid), very convex dorsally; the rostrum comprising less than half the total length, sharply downcurved (Fig. 6C); the head broad in relation to overall length, appearing swollen (hence *subglobosa*, Fig. 6D). Ovicells prominent, longer than broad, narrowly attached to the inner distal angle of the bearing zooid, transversely orientated (Fig. 6A); the opening directed downwards and across the end of the bearing zooid, concealed from most viewpoints, opposite the avicularium of the succeeding zooid. Embryos pale milky yellow. Tentacle number about 18.

The Siboga specimen (British Museum 1928.3.6.91) from North Celebes has larger zooids, 0.7 (SD 0.03) $\times$ 0.15 (SD 0.04) mm, but is of the same delicate colony form.

OCCURRENCE

Found, usually with *B. vectifera*, among the under fauna of several boulders in the tract at Blue Pools, 27-31 Jul 1988. First record from Australia.

DISTRIBUTION

Great Barrier Reef, Flores, Sumbawa, Timor, North Celebes and eastern Honshu, Japan (Harmer, 1926).

Family BEANIIDAE Canu & Bassler, 1927

Colony encrusting, loosely adherent, unilaminar; or erect, bilaminar, foliaceous; attached to substratum by rhizoids. Autozooids contiguous to widely disjunct, linked by long or short tubular extrusions of the mural septula.

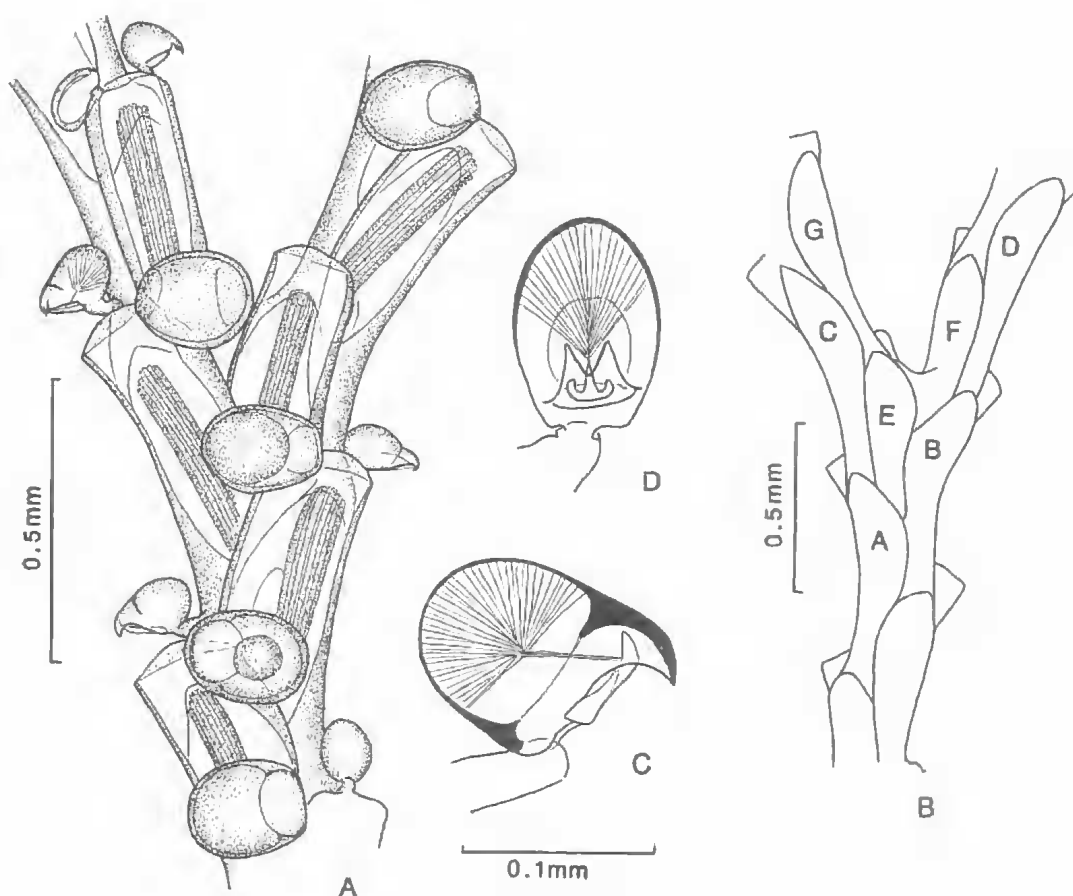


FIG. 6. *Bugula subglobosa*. A, Part of a branch, with autozooids bearing ovicells and avicularia. B, A dichotomy in basal view. C, Avicularium. D, Avicularium in distal view.

Frontal surface entirely membranous, with or without a border of marginal spines. Avicularia adventitious, pedunculate, of bird's head form. Ovicells present or absent.

Beania Johnston, 1840

Colony encrusting, unilaminar, ramifying or reticulate, attached to the substratum by rhizoids and generally loosely adherent. Autozooids closely packed, or widely spaced apart, but not contiguous, linked to each other by tubular extensions of mural pore chambers; recumbent, or erect, sometimes with an elongate, narrowly tubular, proximal portion. Frontal membrane occupying whole of broad distal portion of autozooid, bordered by thin spines in many species; distal spines or spinous processes present or absent. Avicularia present or absent; peduncu-

late, with a hooked rostrum. Ovicells reduced, vestigial or absent.

Type species: *Beania mirabilis* Johnston, 1840.

Beania magellanica (Busk)

Diachoris magellanica Busk, 1852b: 54, pl.67, figs 1-3.

Beania magellanica: Harmer, 1926: 412, pl. 28, figs 1-4, text-fig.1; Gordon, 1984: 46, pl. 11, fig. H.

DESCRIPTION

This species is distinguished from all other species of *Beania* by the six, regularly-arranged connecting tubes linking each autozooid with its neighbours, by a complete absence of spines, except for two to four tiny processes at the distal end of the autozooid, and by its greatly enlarged, paired avicularia. It is probably common in reef

habitats, but its filmy, transparent colonies are quite inconspicuous in the field, and only become readily apparent once specimens begin to dry.

DISTRIBUTION

Beania magellanica seems to be practically ubiquitous in tropical, subtropical and temperate seas. It has a circumpolar distribution in the Southern Ocean, though not extending into Antarctic waters, and in the western Pacific ranges northwards to Japan, and in the Atlantic region as far as the Mediterranean. It is certainly present in the eastern Pacific (Osburn, 1950) and probably occurs throughout the Indian Ocean.

Family CABEREIDAE Busk, 1852a

Colony erect, branching, jointed, attached to substratum by rhizoids; branches dividing dichotomously, unilaminar, with frontal and basal surfaces, autozooids in two, sometimes more, alternating longitudinal series. Autozooids well calcified, with moderately sized opesia; cryptocyst generally narrow, gymnocyst well developed. Spines present, or rarely, absent, one often modified as a flat plate, the scutum, overarching the frontal membrane. Avicularia adventitious, sessile, sometimes absent; vibracula generally present on basal surface. Ovicell hyperstomial, prominent.

Scrupocellaria van Beneden, 1845

Colony branching, erect and bushy, or repent and spreading; attached to the substratum by rhizoids. Branches biserial, with defined frontal and abfrontal faces, dividing dichotomously at regular intervals, each jointed at its base. Autozooids with well developed gymnocyst and oval frontal membrane; spines usually present at distal end of autozooid; a specially modified lateral spine, or scutum, present in many species, flattened and arching over the frontal membrane, sometimes hiding it completely. Heterozooids polymorphic: lateral avicularia typically present at outer distal angles of autozooids, often dimorphic; frontal avicularia often present on gymnocyst, also often dimorphic; vibracula typically present on abfrontal surfaces. Ovicell hyperstomial, globular, with or without pores, or larger fenestrae.

Type species: *Sertularia scruposa* Linnaeus, 1758.

Species of *Scrupocellaria* may be quite common in shallow reefal habitats, forming swards

on the undersides of boulders, in association with other erect Cheilostomata, such as *Margaretta*, *Nellia* and *Vasignyella*. Three common tropical/subtropical species occur on the reef flats of Heron Island.

Scrupocellaria diadema Busk (Fig. 7)

Scrupocellaria diadema Busk, 1852a: 370; 1852b: 24, pl. 28, figs 1-3.

Scrupocellaria diadema: Harmer, 1926: 375, pl. 25, figs 20-25; Ryland, 1984: 68, fig. 3; Hayward, 1988: 285, fig. 3C.

DESCRIPTION

This species forms stout, bushy, erect colonies. Autozooids 0.35–0.5 mm long, with the opesia comprising about three-quarters total length; the

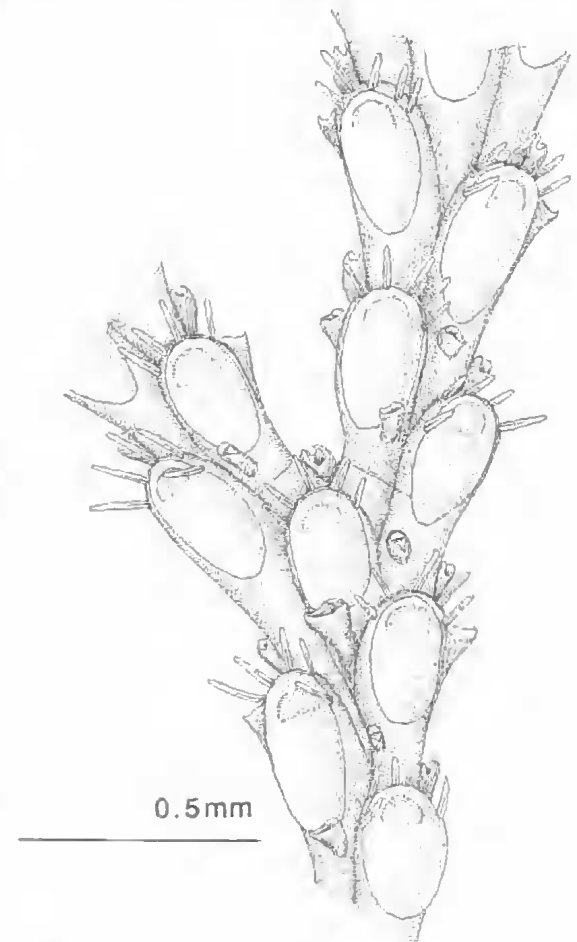


FIG. 7. *Scrupocellaria diadema*.

opesiae of the two series of autozooids overlapping along the branch. Each autozooid with two pairs of short, disto-lateral spines, and a single median distal spine; scutum narrowly oval, covering just the central area of the frontal membrane, but frequently absent. Disto-lateral avicularia small, monomorphic, a single, abfrontal vibraculum just visible distal to each; frontal avicularia shortly columnar, with the rostrum almost perpendicular to frontal plane, dimorphic, those borne by autozooids proximal to dichotomies greatly enlarged; a single vibraculum occurs in the axil of each dichotomy. Ovicell characteristic: wider than long, with conspicuous tubiform pores.

DISTRIBUTION

S. diadema was described from Moreton Bay, Queensland. It ranges northwards to Japan, throughout the Indo-Malaysian region, and westwards to India and Mauritius.

Scrupocellaria maderensis Busk (Fig. 8)

Scrupocellaria maderensis Busk, 1860: 280; 1861: 77, pl. 32, fig. 1,

Scrupocellaria maderensis: Harmer, 1926: 372, pl. 25, figs 16-19; Gordon, 1984: 47, pl. 12, figs F,G; Ryland, 1984, fig. 2; Hayward, 1988: 283.

DESCRIPTION

Colony an erect, freely branching tuft, with the internodes between dichotomies often exceeding 2mm. Autozooids commonly about 0.35mm long; opesia small and round, comprising less than half total autozooid length, and those of the two autozooid series do not overlap along the branch. Up to four short spines on the outer distal corner of the autozooid, one or two on the inner; the scutum, invariably present, is rounded, with a straight distal edge, and almost completely hides the frontal membrane proximal to the operculum. Disto-lateral avicularia monomorphic, very large, with hooked rostrum, giving a serrated outline to the branch edge; frontal avicularia usually absent; vibraculum present on the abfrontal surface of each autozooid, and two in the axil of the dichotomy. Ovicell longer than wide, tilted towards axis of branch; flattened frontally, with a single fenestra.

DISTRIBUTION

Scrupocellaria maderensis is widely distributed in the warm temperate and tropical

waters of the eastern Atlantic and Indo-West-Pacific regions. In the western Pacific it ranges from southern New Zealand to Japan.

Scrupocellaria spatulata (d'Orbigny) (Fig. 9)

Cellularia spatulata d'Orbigny 1851: 50.

Scrupocellaria spatulata: Harmer, 1926: 382, pl. 26, figs 1-10; Winston & Heimberg, 1986: 7, figs 11-12; Hayward, 1988: 283.

DESCRIPTION

Colony forming delicate, spreading tufts up to 10mm high. Autozooids slender, 0.4-0.5mm long, the opesia comprising slightly less than half total frontal length; two series of opesiae just overlapping along the branch. Two or three spines on the outer distal corner of the autozooid, and usually two on the inner; non-ovicellate autozooids may have, in addition, one or two median distal spines; scutum narrowly oval, covering only a small central portion of the frontal membrane. Disto-lateral avicularia dimorphic: most usually tiny, with a laterally orientated, triangular mandible, occasionally

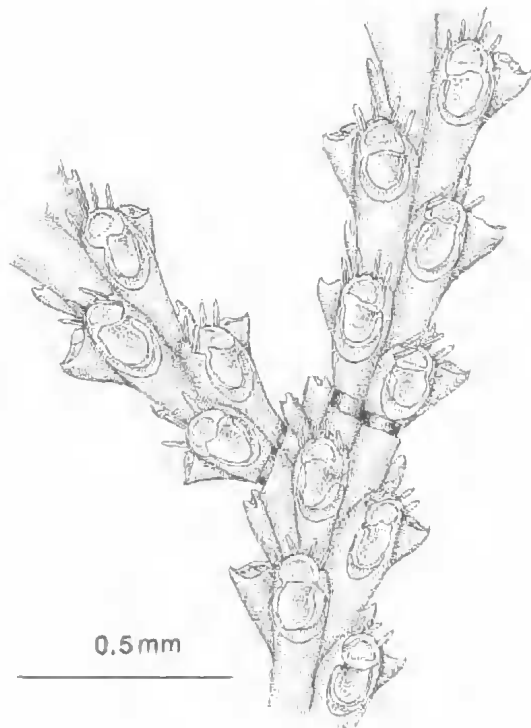


FIG. 8. *Scrupocellaria maderensis*

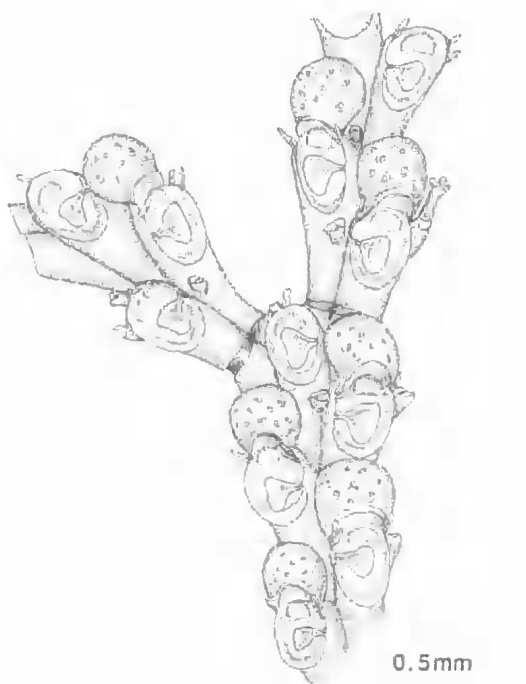


FIG. 9. *Scrupocellaria spatulata*.

replaced by a grossly enlarged type with slender, digitate rostrum orientated parallel to the long axis of the branch; frontal avicularia sparse, monomorphic, columnar, situated close to the base of the scutum of the adjacent autozooid; a single vibraculum on the abfrontal surface of each autozooid, and one in the axil of each dichotomy. Ovicell as wide as long, globular, with small, regular perforations.

DISTRIBUTION

This species is distributed throughout the Indo-West-Pacific region, from Queensland to East Africa, and from Victoria northwards to the Philippines.

Superfamily MICROPOROIDEA Gray, 1848

Family MICROPORIDAE Gray, 1848

Colony encrusting or erect. Autozooids with membranous frontal wall underlain by an extensive cryptocyst; opesia reduced, often scarcely exceeding area of operculum; gymnocyst usually little developed. Spines present or absent. Avicularia present, adventitious, interzooidal or vicarious. Ovicells present or absent. Vertical walls with basal pore chambers or mural septula.

Micropora Gray, 1848

Colony encrusting. Autozooids typically flat, with lateral walls raised and thickened, and often developed as prominent umbones lateral to the opesia; frontal membrane entirely underlain by a thickly calcified, perforate cryptocyst, with paired opesiules situated close to its distal corners; opesia small, exactly coincident with orifice, with a thickened rim; no gymnocyst. Spines present or absent. Avicularia vicarious, smaller than autozooids; lacking in some species. Ovicells partly immersed, prominent, with small, scattered pores; closed by autozooid operculum. Vertical walls with large mural septula, which may extend to the basal wall.

Type species: *Flustra coriacea* Johnston, 1847.

Micropora angusta MacGillivray (Fig. 10a)

Micropora coriacea var. *angusta* MacGillivray, 1887: 67.

Micropora sugittata d'Hondt, 1986: 712, pl. 6, figs 1,2.

DESCRIPTION

Colony loosely encrusting, forming flat, multi-laminar sheets. Autozooids narrowly rectangular, 0.6-0.75 × 0.25-0.3mm; cryptocyst flat, finely granular, densely perforated, bounded by a thick, crenulate mural rim. Opesia raised above plane of cryptocyst, its lower lip almost perpendicular, thick, with a crenulate rim; more or less semicircular, with rounded corners. No oral spines. Opsiules indistinct. Avicularia relatively large; rostrum 0.16mm long, with broadly triangular mandible, proximo-laterally directed. Ovicell elongate oval, surface coarsely granular, with numerous tiny perforations; opesia of ovicellate autozooids longer than in non-ovicellate autozooids.

REMARKS

MacGillivray (1887) described the morphology of this species quite precisely although, regarding it simply as an interesting variant of *M. coriacea* Johnston, he unfortunately did not figure it or give a locality for his material. D'Hondt's material, which is unquestionably the same species as that from Heron Island, was from New Caledonia. P.L. Cook (in litt.) has re-examined MacGillivray's specimens of *M. coriacea* var. *angusta*, in the Victoria Museum, Melbourne, and reports that it is the same species as recorded here from Heron Island; specimen F45537A, Port

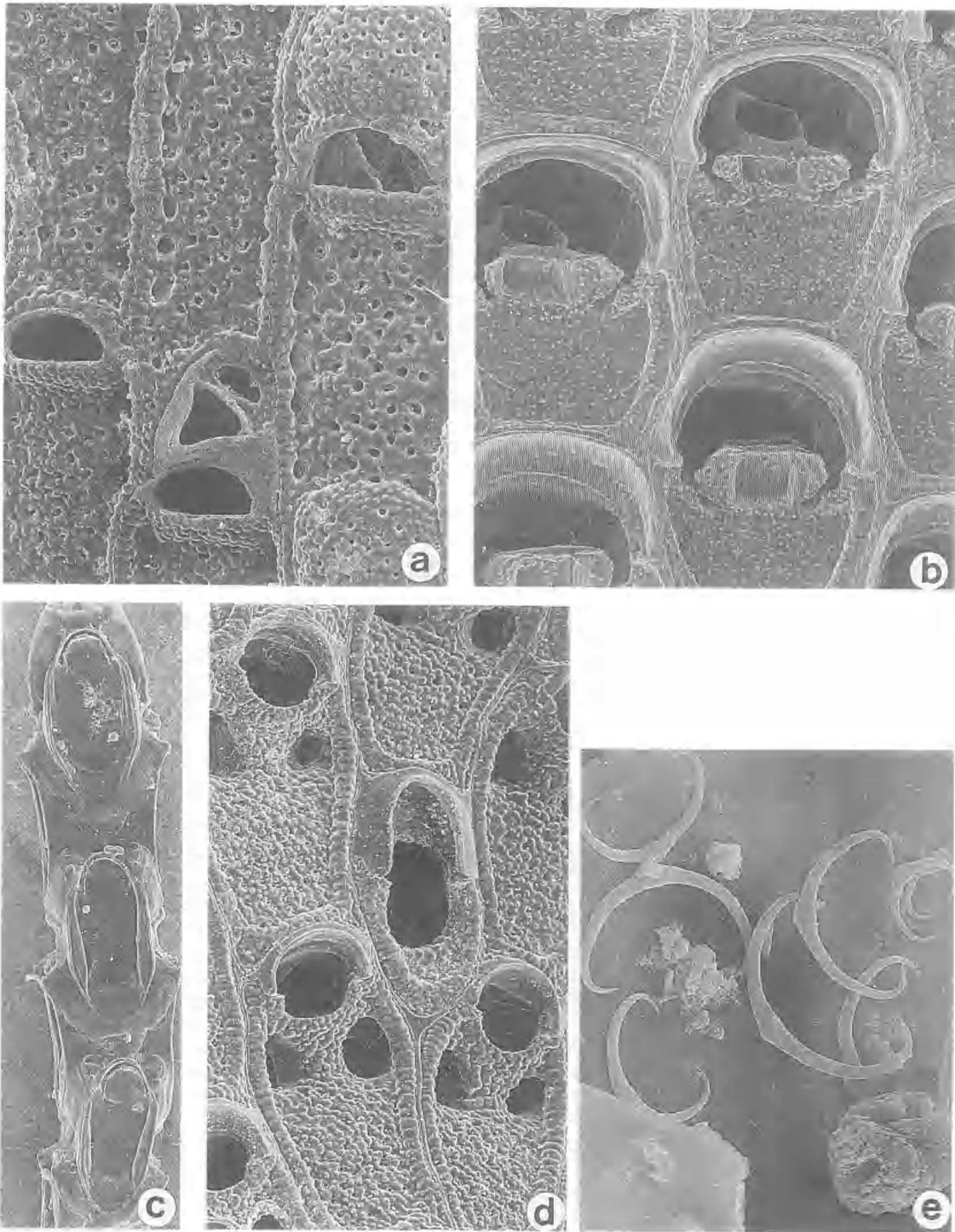


FIG. 10. a, *Micropora angusta*, $\times 110$. b, *Steginoporella magnilabris*, $\times 50$. c, *Nellia tenuis*, $\times 70$. d, e *Thalamoporella stapifera*; d, autozooids and an avicularium, $\times 70$; e, group of calipers, $\times 800$.

Phillip Heads, is here designated as lectotype of *Micropora angusta* MacGillivray. The loosely encrusting, multilaminar colony form, and the finely punctate ovicell are unusual features for a species of *Micropora*.

***Micropora variperforata* Waters
(Fig. 2f)**

Micropora variperforata Waters, 1887: 51, pl. 8, fig. 27.
Micropora variperforata: Gordon, 1986: 69, pl. 27, fig. B.

DESCRIPTION

Colony forming an irregular, spreading unilaminar sheet. Autozooids oval to hexagonal, $0.45\text{--}0.6 \times 0.35\text{--}0.4\text{ mm}$; cryptocyst flat, nodular, with about 20–35 small, randomly distributed pores; opesiules recessed but distinct, proximolateral to opesia; an irregular series of comparatively large pores developed around the margins of the cryptocyst; mural rim crenulate, thickened, in later ontogeny continuous with a conspicuous proximal ridge of cryptocystal calcification. Opesia wider than long, $0.12\text{--}0.14 \times 0.06\text{--}0.08\text{ mm}$; no oral spines. Avicularium scarcely larger than opesia; rostrum triangular, acute to frontal plane and laterally directed. Ovicell about as wide as long, the surface finely nodular, except for a smooth or faintly striated frontal band immediately above the aperture.

DISTRIBUTION

Several colonies occurred in sample 22, from the reef crest, northeast of the cay. The Heron Island specimens are strikingly similar to the Recent New Zealand material figured by Gordon (1986), so that *M. variperforata* is known from the western South Island of New Zealand as well as from New Zealand Tertiary deposits.

Family STEGINOPORELLIDAE Hincks, 1884

Colony encrusting; or erect, frondose or vinulariiform, attached by an encrusting base. Autozooids with well developed cryptocyst, which descends to basal wall in distal half of zooid, delimiting a tube for the exsertion of the polypide; gymnocyst reduced or lacking. Autozooids often dimorphic: unmodified A zooids represent majority; B zooids, perhaps primitive avicularia, are characterized by enlarged, toothed opercula. No ovicells. Vertical walls with multiporous mural septula.

***Steginoporella* Smitt 1873**

Colony encrusting, or erect, frondose or narrow and branched. Autozooids typically dimorphic, both types containing polypides, distinguished principally by relative size of operculum. Frontal wall membranous, lacking a gymnocyst; underlain by a concave cryptocyst, which descends to the distal wall or to the basal wall in the distal half of the zooid, thus dividing its cavity into two chambers; withdrawn polypide located in proximal chamber, exserting via a tubular foramen ('polypide tube') in the distal part of the cryptocyst. Vertical walls of autozooids with large multiporous septula. No ovicells; embryos brooded within maternal autozooids. No spines. B zooids, characterized by enlarged and thickly sclerotized opercula, perhaps represent primitive vicarious avicularia.

Type species: *Membranipora magnilabris* Busk, 1854.

***Steginoporella magnilabris* (Busk)
(Fig. 10b)**

Membranipora magnilabris Busk, 1854: 62, pl. 65, fig. 4.

Steganoporella magnilabris: Harmer, 1926: 277, pl. 17, figs 1–3, 7, 9, 12, text-fig. 10; Cook, 1964a: 53, pl. 1, fig. 4, text-fig. 2.

Steginoporella magnilabris: Winston, 1984: 10, figs 17, 18.

DESCRIPTION

Colony forming extensive, flat, encrusting sheets, or occasionally erect, bilaminar or unilaminar plates; deep reddish-brown or horn-coloured. Autozooids rounded distally, straight proximally, commonly $0.9\text{--}1.0 \times 0.6\text{--}0.7\text{ mm}$. Frontal membrane thick, opaque, bordered by a raised, crenulate mural rim; A zooids with distinctive semicircular operculum, as wide as zooid and about half as long, with a dark brown arched sclerite, and a submarginal series of small teeth on its inner face; B zooids, having proportionately much larger operculum, armed with stout, conspicuous, marginal teeth on its inner face, varying in frequency, from 0.2–30% in different geographical populations (Cook, 1964a). Cryptocyst occupying about half total length of autozooid, depressed, finely nodular, with numerous fine perforations; descending abruptly to basal wall of autozooid, with rounded polypide tube situated centrally in vertical distal part of cryptocyst and not visible in frontal view. Upper

distal edge of cryptocyst produced as a concave, or deeply cupped, process immediately above polypide tube. Distal half of autozoid with a raised rim supporting the operculum, below which is a broad oral shelf.

DISTRIBUTION

S. magnilabris occurs in shallow tropical waters, from the Caribbean, West Africa, East Africa and the Indian Ocean, Malaysia, Indonesia and the Philippines, and northwards to southern Japan.

Family THALAMOPORELLIDAE Levinsen, 1909

Colony encrusting or erect. Autozooids with frontal membrane entirely underlain by a granular, concave cryptocyst; opesia usually coincident with operculum; single or paired opesiules present, large. No gymnocyst. Avicularia vicarious. Ovicell large, bivalved; or lacking. Vertical walls with multiporous mural septula.

Thalamoporella Hincks, 1887

Colony encrusting or erect. Autozooids with membranous frontal wall underlain by extensive cryptocyst; no gymnocyst calcification. Cryptocyst concave or depressed, with a pair of large opesiules bounded by basally deflected cryptocyst, which may extend to the basal wall; opesia small, usually almost coincident with operculum. No spines. Avicularia vicarious. Ovicell bulbous; bivalved, with a longitudinal median suture, borne by a modified maternal zoid. Vertical walls with multiporous septula. Calcareous spicules, of unknown significance, present in cavity of autozoid.

Type species: *Flustra rozieri* Audouin, 1826.

Thalamoporella granulata Levinsen (Fig. 11a,b)

Thalamoporella granulata Levinsen, 1909: 789 (part), pl. 6a, figs 1a-f.

Thalamoporella granulata: Harmer, 1926: 297.

DESCRIPTION

Colony forming a flat, encrusting sheet. Autozooids rectangular to polygonal, bounded by low, crenulate, mural rims; $0.6-0.7 \times 0.3-0.4$ mm. Cryptocyst with finely beaded surface, flat or slightly convex proximally, concave distally;

opesiules irregularly oval, of unequal size, bounded proximally and laterally by descending cryptocyst which reaches to the basal wall of the autozoid; opesia with semicircular distal rim, its proximal edge shallowly concave. Avicularium as long as autozoid; rostrum constituting half total length, narrowly spatulate, curved laterally to left or right, the autozoid embraced by the curve consequently with an asymmetrically placed opesia. Brooding zoid shorter than autozoid, with proportionately broader opesia; capped by a thin-walled, bivalved ovicell, with triangular aperture closed by a modified operculum. Spicules of two types: widely opened compasses, of two sizes, and small, closed calipers.

DISTRIBUTION

The type locality for this species is Torres Strait; Harmer (1926) redescribed the material on which Levinsen (1909) founded *T. granulata*, but the species does not seem to have been reported subsequently from elsewhere. It appears common at Heron Island; large colonies were present in three of the samples reported on here.

Thalamoporella stapifera Levinsen (Fig. 10d,e)

Thalamoporella granulata var. *stapifera* Levinsen, 1909: 188, pl. 6, figs 5a-c.

Thalamoporella stapifera: Harmer, 1926: 297, pl. 19, figs 17, 20, 25; Soule & Soule, 1970: 10, figs 4C-G; Winston & Heimberg, 1986: 8, figs 13-16.

DESCRIPTION

Colony forming a broad, flat, encrusting sheet. Autozooids elongate, rectangular to irregularly hexagonal, bounded by thick, crenulate mural rims; $0.6-0.8 \times 0.25-0.5$ mm. Cryptocyst more or less flat, slightly concave proximal to opesia; opesiules irregularly oval, of equal or unequal size, cryptocyst descending to basal wall, to form complete tube; opesia with semicircular distal rim, its proximal edge deeply concave. Avicularium shorter than autozoid; rostrum constituting less than half total length, symmetrical, distally rounded. Brooding zoid shorter than autozoid, with proportionately broader opesia, and especially pronounced opesiular tubes; ovicell thin-walled, bulbous, with triangular aperture closed by a modified operculum. Spicules of two types: widely open compasses, and large, wishbone-shaped calipers.

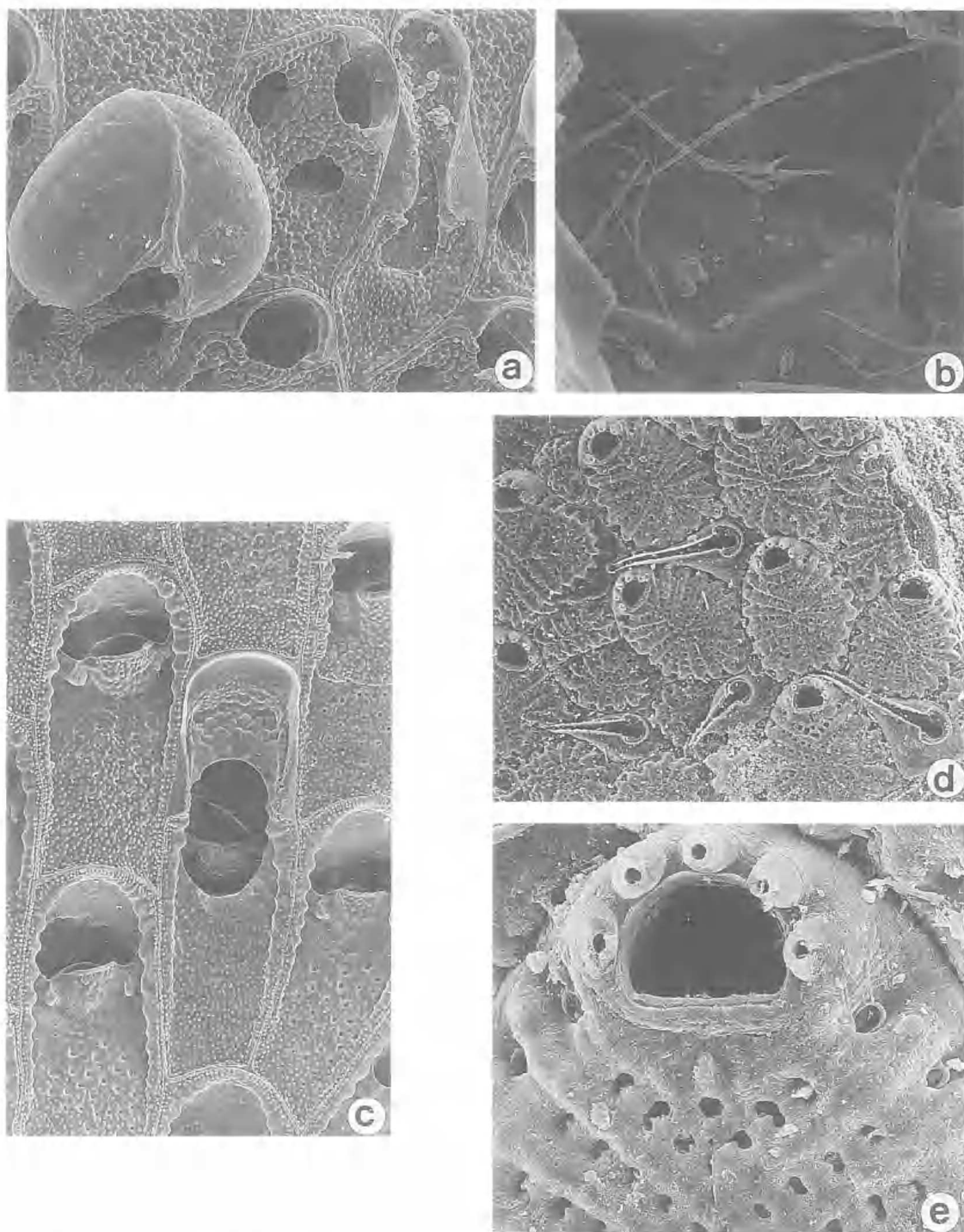


FIG. 11. a,b, *Thalamoporella granulata*; a, autozooids, an ovicell and an avicularium, $\times 70$; b, group of compasses, $\times 250$. c, *Labioporella bursaria*, $\times 60$. d,e, *Puellina egretta*; d, $\times 65$; e, $\times 400$.

DISTRIBUTION

This species has been reported from Hawaii, Timor, Lombok and Mauritius, and is perhaps widely distributed through the Indo-West-Pacific realm. It has not been previously recorded from Australia. It was present in two of the Heron Island samples, numbers 24 and 26.

***Labioporella* Harmer, 1926**

Colony encrusting or erect. Autozooids with membranous frontal wall underlain by extensive, porous cryptocyst; opesia constituting one-third or less of total length; no gymnocyst. Distal edge of cryptocyst deflected to meet basal wall, dividing cavity of cystid into two parts, forming a prominent tube through which the polypide passes on eversion. No spines. Avicularia vicarious, with extensive palatal cryptocyst; cystid divided by transverse septum, rostrum with proximo-lateral condyles but no crossbar. No ovicells. Vertical walls with multiporous septula.

Type species: *Labiopora crenulata* Levinsen, 1909.

***Labioporella bursaria* (MacGillivray)**

(Fig. 11c)

Amphiblestrum bursarium MacGillivray, 1887; 66, pl. 2, fig. 2.

Labioporella bursaria; Harmer, 1926; 285, pl. 21, figs 12, 15.

DESCRIPTION

Colony forming flat, unilaminar, encrusting sheets. Autozooids elongate, rectangular, separated by distinct sutures; $0.6-0.85 \times c. 0.35$ mm. Mural rim raised and crenulate in distal half of autozoid, smoothly rounded along middle portion of distal terminal wall for reception of operculum. Cryptocyst occupying three-quarters of autozoid length, finely granular, with a group of about 30 small pores in its middle region; flat, dipping sharply adjacent to polypide tube, which is markedly convex frontally, with a transversely oval aperture. Avicularia as large as autozooids; cryptocyst finely granular, imperforate, with an oval foramen through which a transverse, medially-thickened septum is visible, dividing the cystid cavity in half; rostrum slightly less than half length of avicularium, smoothly rounded, semi-elliptical, with thickened, proximo-lateral condyles.

DISTRIBUTION

Described by Harmer (1926) from Queensland and the Celebes, *L. bursaria* is also known from Victoria and South Australia. At Heron Island it occurred in two samples, from the reef flat and the reef crest south of the cay.

Suborder ASCOPHORINA Levinsen, 1909

Superfamily CRIBRILINOIDEA Hincks, 1879

Family CRIBRILINIDAE Hincks, 1879

Colony encrusting, sheet-like; or erect, attached by an encrusting base. Frontal surface of autozooids consisting of a shield of fused, flattened spines (costae) overarching the frontal membrane; costae hollow, often with one or more uncalcified spots (pelmaticia) and with intercostal spaces between the points of fusion permitting the passage of water to the space between the shield and the membrane. Distal oral spines present or absent. Avicularia adventitious or vicarious, or lacking. Ovicell hyperstomial. Vertical walls with basal pore chambers or mural septula.

***Puellina* Jullien, 1886**

Colony encrusting, unilaminar. Autozooids with reduced proximal gymnocyst, and costate frontal shield covering whole of frontal membrane. Frontal shield consisting of radiating series of costae, each fused at intervals along lateral margins, with small intercostal pores between points of fusion; each costa with one or more uncalcified frontal pores (pelmaticia). Operculum D-shaped, closely fitting a calcified secondary orifice, proximal edge of which (apertural bar) is formed by the first pair of costae. Short, slender spines present around distal and lateral borders of orifice. A pair of slender, non-calcified papillae present, proximo-lateral to orifice, each protruding through a proximal intercostal pore. Avicularia interzooidal, with well-developed gymnocrystal cystid. Ovicell hyperstomial, imperforate, closed by autozoid operculum. Basal pore chambers present. Ancestrula tatiform.

Type species: *Lepralia gattyae* Landsborough, 1852.

Species of *Puellina* are frequently characterized by the small size of both autozooids and colony. They are abundant in all temperate and tropical seas, apparently favouring biogenic carbonate substrata. They are all confusingly similar and many more species may exist than has been

previously recognized. Bishop & Househam (1987) reviewed species of *Puellina* in British coastal waters, and redescribed and figured *P. innominata* (Couch), which, together with *P. radiata* (Moll), has been reported from almost all the world's seas. All records of these, and other, species of *Puellina* (formerly *Cribrilaria*) need to be examined in the light of Bishop & Househam's (1987) work. The three species here described from Heron Island have probably been reported previously from Queensland and adjacent areas as *P. innominata* or *P. radiata*. Features important in identifying species of *Puellina* are: size and shape of orifice, number of spines, form of the suborificial lacuna, and morphology of the avicularium.

***Puellina decipiens* sp. nov.**
(Fig. 12d,e)

TYPE MATERIAL

HOLOTYPE: GH5225, Heron Island, Stn 22, 15 Apr 1972.

ETYMOLOGY

Latin *decipio*, -ere, to beguile or cheat.

DESCRIPTION

Autozooids broadly oval, flat, separated by shallow grooves. Gymnocyst limited to a narrow, proximal band; frontal shield consisting of about 16 fused costae, each with a pronounced tubercle basally (i.e., at periphery) bearing the single pelmatidium. A single, large, transversely oval lacuna immediately proximal to the apertural bar. Secondary orifice wider than long, with five, evenly spaced disto-lateral spines, four persisting in ovicelled autozooids. Avicularia infrequent; cystid small, inconspicuous, rostrum elongate triangular. Ovicell slightly wider than long, with indistinct longitudinal carina.

Measurements (means and standard deviations of 20 values, mm): autozooid length 0.29 ± 0.02 ; width 0.21 ± 0.02 ; orifice length 0.05 ± 0.002 ; width 0.06 ± 0.003 ; avicularium length 0.10 ± 0.01 ($n = 14$).

REMARKS

The short avicularium is very similar to that of the European *P. innominata* (Couch), but *P. decipiens* differs from that, and other, species of *Puellina* in its very large subapertural lacuna and flat, non-umbonate frontal shield.

***Puellina egretta* sp. nov.**
(Fig. 11d,e)

Cribrilaria aff. *radiata*: Ristedt, 1985: 20, fig. 3e-h.

TYPE MATERIAL

HOLOTYPE: GH5226, Heron Island, Stn 12, 12 Apr 1972.

ETYMOLOGY

French *aigrette*, a heron.

DESCRIPTION

Autozooids broadly oval to irregular, flat, separated by deep grooves. Gymnocyst minimally developed, inconspicuous; frontal shield formed from about 19 fused costae, each broadened but scarcely tuberculate proximally, pelmatidia indistinct. Apertural bar with a small median thickening; proximal to which is a small, round lacuna, clearly distinct from the first series of intercostal pores. Secondary orifice wider than long; five closely spaced oral spines present. Avicularia frequent; cystid well developed, with broad, smooth gymnocyst; rostrum slender, elongate, directed disto-medially along the border of the adjoining autozooid, Ovicell not found.

Measurements (means and standard deviations of 20 values, mm): autozooid length 0.34 ± 0.03 ; width 0.27 ± 0.03 ; orifice length 0.05 ± 0.003 ; width 0.07 ± 0.005 ; avicularium rostrum length 0.24 ± 0.05 .

REMARKS

This species develops rather larger colonies than the other two described here, and is thus more immediately obvious. The broad, flat autozooids and numerous elongate avicularia are especially distinctive.

DISTRIBUTION

Ristedt (1985) figured specimens of a *Puellina* from the Seychelles and the Philippine Islands which are clearly referable to *P. egretta*.

***Puellina vulgaris* sp. nov.**
(Fig. 12b,c)

TYPE MATERIAL

HOLOTYPE: GH5227, Heron Island, Stn 23, 16 Apr 1972.

ETYMOLOGY

Latin *vulgaris*, commonplace or ordinary.

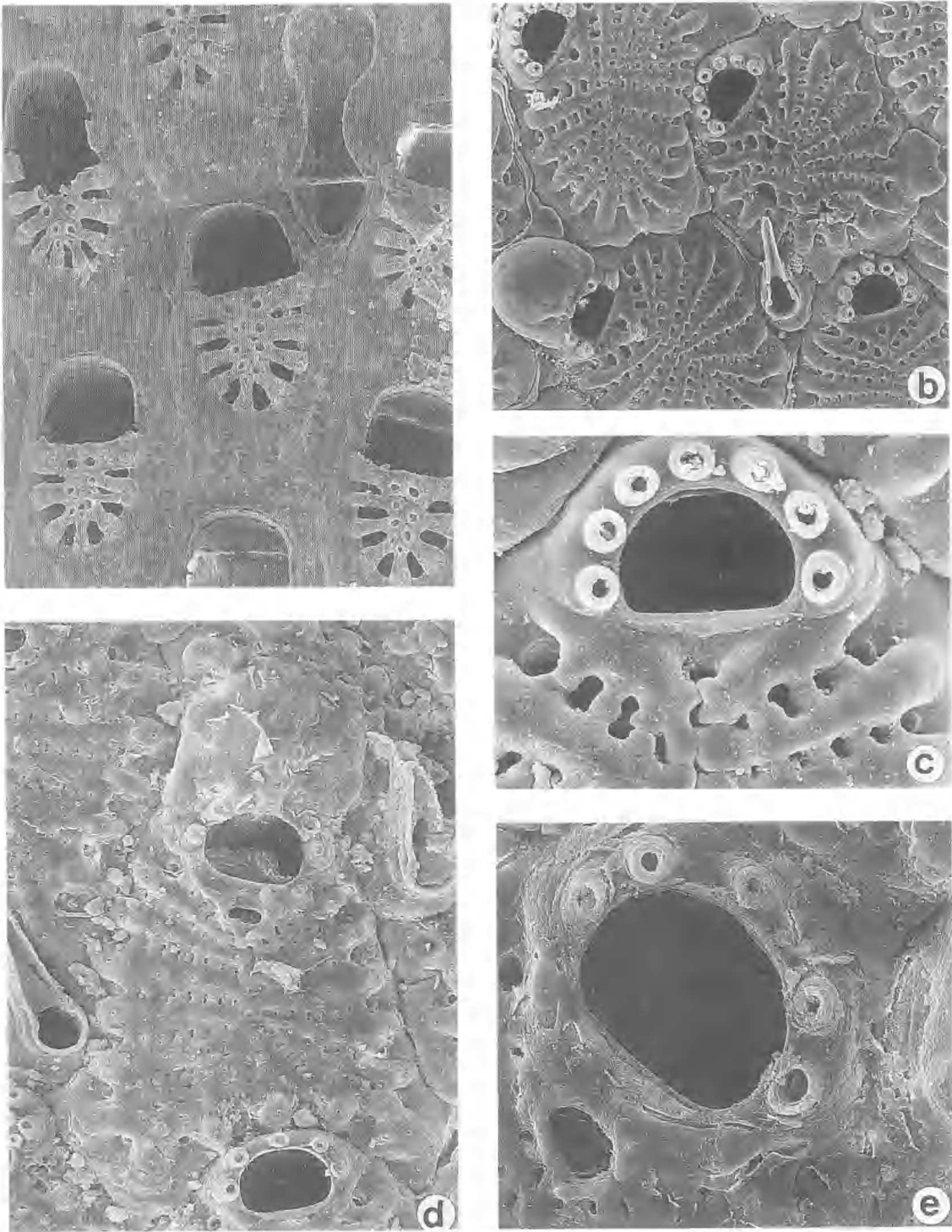


FIG. 12. a, *Figularia fissa*, $\times 75$. b,c, *Puellina vulgaris*; b, $\times 130$; c, $\times 450$. d,e, *Puellina decipiens*; d, $\times 220$; e, $\times 500$.

DESCRIPTION

Colony forming small unilaminar patches. Autozooids oval, convex, separated by deep grooves. Gymnocyte clearly visible as a smooth border around the autozooid; frontal shield formed from 15-16 costae, each broadened proximally but not tuberculate; pematidia indistinct; intercostal pores relatively large, particularly in distal half of shield. A single, moderately sized subapertural lacuna present. Secondary orifice wider than long, with seven closely spaced spines, four persisting in ovicelled autozooids. Avicularia infrequent; cystid small, indistinct; rostrum narrowly triangular, relatively short, directed distally or disto-laterally. Ovicell spherical, as wide as long, with a small frontal umbo. Measurements (means and standard deviation of 20 values, mm): autozooid length 0.27 ± 0.02 ; width 0.21 ± 0.02 ; orifice length 0.04 ± 0.003 ; width 0.05 ± 0.005 ; avicularium rostrum length 0.12 ± 0.02 ($n = 5$).

REMARKS

The seven oral spines, conspicuous subapertural lacuna, and rather small avicularium together distinguish this species from other tropical species of *Puellina*.

Figularia Jullien, 1886

Colony encrusting. Autozooids with well-developed gymnocyte and, often extensive, costate frontal shield; costae fused medially and along their length, with a few irregular pores between the points of fusion, and with one or more pseudopores on each. Aperture rounded-quadrangular; operculum pivoting on lateral condyles, frequently compound, with a transverse line of flexure level with the condyles. Oral spines present or absent. Avicularia vicarious or interzooidal, generally sparse. Ovicell hyperstomial, prominent, closed by autozooidal operculum; typically with a longitudinal, median suture, and one or more large pores, or fenestrae, on each side. Vertical walls with uniporous or multiporous septula. Ancestrula tatiform.

Type species: *Lepralia figularis* Johnston, 1847.

Figularia fissa (Hincks)
(Fig. 12a)

Cribrellina figularis var. *fissa* Hincks, 1880a: 196, pl. 26, fig. 8.

Figularia fissa: Harmet, 1926: 478, pl. 34, figs 19-23.

DESCRIPTION

Colony forming extensive, unilaminar sheets; brownish-coloured, with the opercula of the autozooids conspicuously dark mahogany. Autozooids elongate, convex, with costate frontal shield comprising about one-third total length; $0.55-0.8 \times c. 0.35$ mm. Costae flat, 8-10 in total; widely spaced, with elongate gaps between, each with a single, distal, pseudopore. Avicularia rare, about as long as autozooid, with a striking, spoon-shaped rostrum. Ovicell wider than long, the ectoecium on each side of the median suture with an elongate, curved, frontal fenestra.

REMARKS

This distinctive species is immediately recognized by its costate frontal shield, which has relatively few, widely spaced costae, and by its characteristic avicularia. *F. fissa* is evidently quite common at Heron Island, and was present in four of the samples described here.

DISTRIBUTION

F. fissa does not seem to have been recorded previously from Australia; it is known to occur in the Indo-Malayan region, from Singapore to New Guinea, and perhaps has a limited distribution in the western Pacific.

Superfamily CATENICELLOIDEA Busk,
1852a

Family SAVIGNYELLIDAE Levinsen, 1909

Colony erect, consisting of branching, uniserial chains of autozooids; jointed, each internode formed from a single clavate autozooid. Frontal wall of autozooids a porous gymnocyte, with or without mural septula; orifice with or without a sinus, its proximal rim sometimes formed from a pair of fused costae; oral spines present or absent. Avicularia adventitious, adjacent to orifice, or lacking. Ovicell present or absent.

Vasignyella Gordon, 1989a

Colony erect to repent, attached by rhizoids. Autozooids elongate, clavate, in branching uniserial chains. Frontal wall largely gymnocyte, with scattered pores; proximal side of orifice bordered by a pair of small, fused costae. No spines. Avicularia paired, lateral to orifice. Ovicell unknown. Large uniporous septula in lateral walls of autozooid.

Type species: *Catenaria otophora* Kirkpatrick, 1890b.

***Vasignyella otophora* (Kirkpatrick)**
(Fig. 14a)

Catenaria otophora Kirkpatrick, 1890b: 17, pl. 5, figs 1a-c.

Savignyella otophora: Harmer, 1957: 763, pl. 51, figs 19-21.

Vasignyella otophora: Gordon, 1989a: 453, figs 13-15.

DESCRIPTION

Colony erect or repent, attached to the substratum by delicate, chitinous rhizoids; composed of uniserial chains of slender, clavate autozooids, branching at irregular intervals. Autozooids very lightly calcified, clavate or fusiform, broadest distally, tapered proximally; 1.0-1.3 × 0.25 mm. Primary orifice terminal, about as wide as long, the proximal edge shallowly concave between indistinct condyles; proximal border of orifice formed by a pair of short, fused costae. Frontal wall evenly perforated by large, round pores; a row of about five large, uniporous septula in each lateral wall. Avicularia lateral to orifice, paired; the rostrum triangular, distally directed, projecting conspicuously. Each autozooid buds another from its disto-basal surface, and one or more additional autozooids may be budded from the lateral septula; the proximal part of each autozooid, immediately above its point of origin, is uncalcified, and appears as a brown, cuticular node.

DISTRIBUTION

V. otophora is probably widely distributed throughout the Indo-West-Pacific realm, but is particularly inconspicuous and has been reported on very few occasions. Most records are centred on the Indo-Malayan region, but it has also been recorded as far west as the Sudanese Red Sea (Dumont, 1981) and, to the east, from Samoa (Gordon, 1989a).

Superfamily HIPPOTHOOIDEA Busk, 1859
Family HIPPOTHOIDAE Busk, 1859

Colony encrusting or erect. Various zooid polymorphs occur, including female zooids and dwarf zooeciules. Autozooids with gymnocystal frontal wall; imperforate, or with small punctae and/or tubercles. Primary orifice rounded or sinuate; condyles present; oral spines generally lacking. Avicularia interzooidal or vicarious, or absent. Ovicell hyperstomial, closed by zooidal operculum; or absent. Vertical walls with basal pore chambers and small mural septula.

***Hippothoa* Lamouroux, 1821**

Colony encrusting, consisting of branching, uniserial chains of polymorphic zooids. Autozooids clavate, with a slender, stolon-like proximal portion; ovicellate female zooids often smaller than autozooids, ovicell with frontal umbo or apical perforation, closed by zooidal operculum; zooeciules minute, cylindrical, with simple orifice, of unknown function. Frontal wall imperforate, smooth, or ridged. Primary orifice with sinus and distinct condyles; no oral spines. No avicularia. Tubular pore chambers in lateral walls. Ancestrula kenozooidal or tatiform.

Type species: *Hippothoa divaricata* Lamouroux, 1821.

***Hippothoa calciophila* Gordon**
(Fig. 13a,b)

Hippothoa calciophila Gordon, 1984: 108, text-fig. 10, pl. 42, figs A-C.

DESCRIPTION

Colony diffuse, spreading widely over the substratum; zooid chains branching in a cruciform manner, each zooid producing one distal and paired lateral buds. Distal, clavate portion of autozooid about 0.3 × 0.15 mm; filiform proximal portion 0.02 mm wide, 1-1.5 × length of distal portion. Primary orifice slightly longer than wide, commonly 0.06 × 0.05 mm, with a deep, broad, U-shaped sinus, and small, rounded condyles. Frontal wall steeply convex, often with fine, transverse corrugations, and a longitudinal ridge. Female zooids most usually laterally budded from autozooids, the distal portion of similar size to autozooids, the filiform proximal portion usually shorter; ovicell with semicircular aperture, and a single, small, apical perforation. Zooeciules sporadic, budded from either or both of the two basal pore chambers on each side of an autozooid; 0.05-0.1 mm long, with minute distal orifice.

REMARKS

H. calciophila has only recently been distinguished from other species of *Hippothoa* (Gordon, 1984). It is probably widely distributed throughout the Great Barrier Reef province, but its small size and cryptic habits render it very inconspicuous.

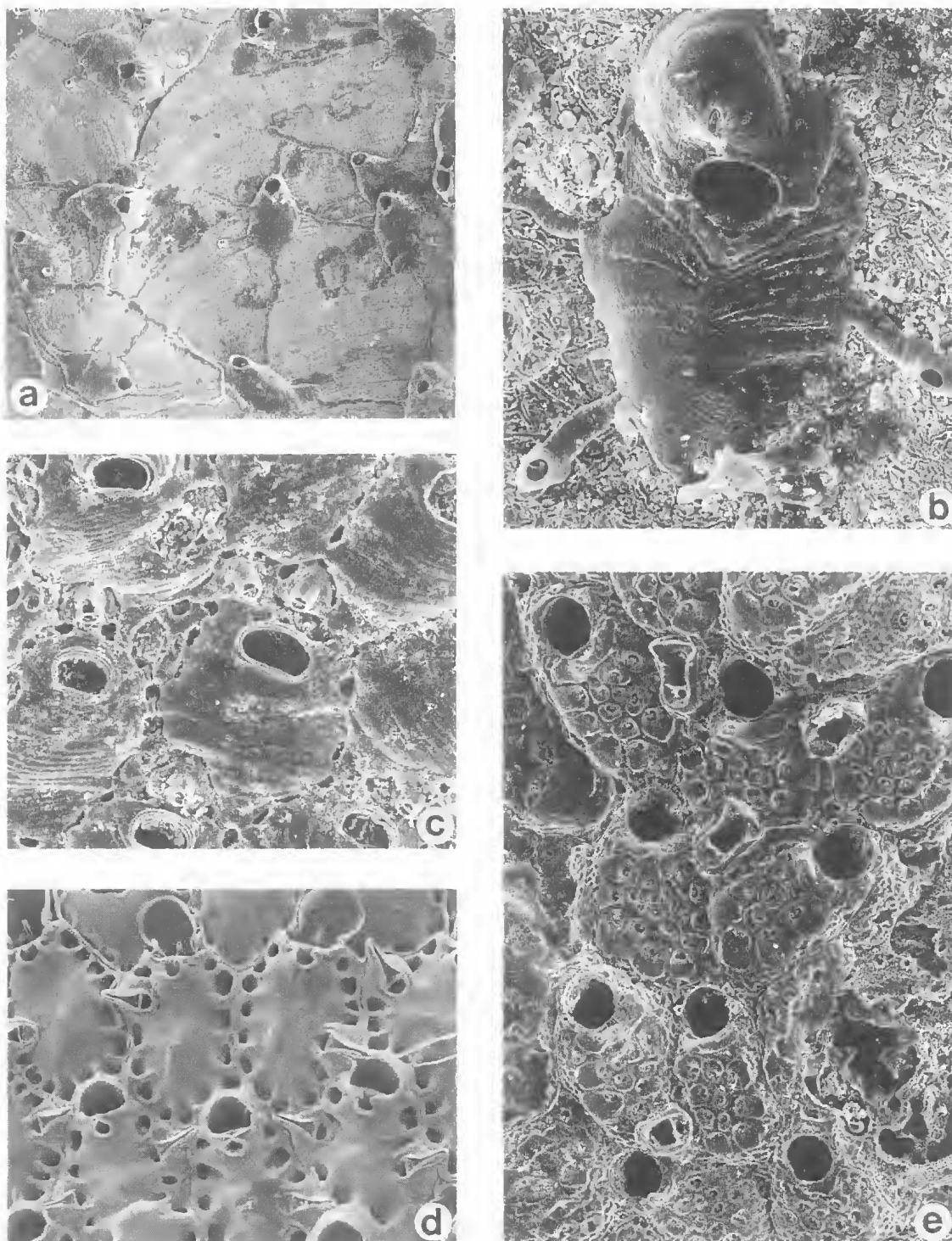


FIG. 13. a,b, *Hippothoa calciophila*; a, part of a colony, $\times 50$; b, a female zooid, with zoocciules, $\times 215$. c, *Chorizopora brongniartii*, $\times 85$. d, *Exochella conjuncta*, $\times 70$. e, *Tremogasterina spathulata*, $\times 65$.

Family CHORIZOPORIDAE Vigneaux, 1949

Colony encrusting, unilaminar. Frontal wall of autozooids imperforate, or with minute punctae. Primary orifice semicircular, without a sinus. Avicularia interzooidal. Ovicell hyperstomial, imperforate. Small kenozooids present. Vertical walls with tubular basal pore chambers.

Chorizopora Hincks, 1879

Colony encrusting, forming thin unilaminar sheets. Autozooids slightly disjunct, linked by tubular extensions of the basal pore chambers. Frontal wall gymnocystal, thinly calcified, imperforate. Primary orifice semicircular or D-shaped; oral spines present or absent. Avicularia vicarious, smaller than autozooids; small kenozooids with rounded membranous frontal fenestrae interspersed among autozooids. Ovicell hyperstomial, imperforate, closed by autozoid operculum.

Type species: *Flustra brongniartii* Audouin, 1826.

Chorizopora brongniartii (Audouin)
(Fig. 13c)

Flustra brongniartii Audouin, 1826: 240; Savigny pl. 10, fig. 6.

Chorizopora brongniartii: Hayward & Ryland, 1979: 240, fig. 103; Gordon, 1984: 113, pl. 44, fig. C; Hayward, 1988: 327.

REMARKS

The thin, hyaline colonies of *C. brongniartii* are inconspicuous on the carbonate substrata it appears to favour and are easily overlooked in wet material. At least three other species of *Chorizopora* are known from New Zealand (Gordon, 1984), but *C. brongniartii* is readily recognized by the smooth or transversely wrinkled, but non-spinous, frontal walls of its autozooids.

DISTRIBUTION

C. brongniartii is widely distributed in all temperate and tropical shelf seas.

Superfamily ARACHNOPUSIOIDEA Jullien,
1888

Family EXECHONELLIDAE Harmer, 1957

Colony encrusting. Autozooids with perforated, umbonuloid frontal wall. Orifice with well marked peristome; lacking spines.

Avicularia adventitious and/or vicarious or interzooidal. Ovicells present or absent.

Tremogasterina Canu, 1911

Colony encrusting or erect, multilaminar. Autozooids with umbonuloid frontal wall, perforated by few, large, frontal foramina, and with small marginal pores. Calcified orifice rim with lateral condyles; no oral spines. Avicularia interzooidal and/or vicarious. Ovicells prominent, hyperstomial, imperforate; not closed by autozoid operculum. Autozooids linked by large, multiporous septula. Ancestrula tatiform.

Type species: *Tremogasterina problematica* Canu, 1911.

Tremogasterina has a worldwide distribution, in shallow coastal waters, between the 30° north and south parallels. The genus was studied in detail by Cook (1977).

Tremogasterina spathulata (Canu & Bassler)
(Fig. 13e)

Hiantopora spathulata Canu & Bassler, 1929: 116, pl. 11, figs 13, 14.

Arachnopusia spathulata: Harmer, 1957: 657, pl. 68, figs 22, 23, 25, 31.

Tremogasterina spathulata: Cook, 1977: 136, pl. 5, fig. A; text- figs 1B, 5A.

DESCRIPTION

Colony forming small, unilaminar patches, generally inconspicuous. Autozooids oval, convex, separated by deep grooves; 0.5-0.6 × 0.3-0.4 mm. Orifice longer than wide, narrowest proximally; proximal edge more or less straight, thickened, and frequently with a short, suboral mucro. Four or five delicate, distal spines present. Frontal wall with a variable number (2-20) of irregular foramina, each with a broad, thick rim, the sutures between giving a tessellated effect; marginal pores inconspicuous. Avicularia sporadic, developed on disto-lateral borders of autozooids, 0.2 mm long, typically distally directed; rostrum spatulate, with straight distal edge, upcurved. Ovicell wider than long.

DISTRIBUTION

Widely distributed in the Indo-West-Pacific region, from the Red Sea to the Philippines. *T. spathulata* is essentially a shallow water species, and its small colonies occur on coral rubble and other hard substrata; on Mauritian reefs it is especially common on the inner reef flat (Hayward,

1988). At Heron Island it was present in half of the samples studied to date.

Superfamily UMBONULOIDEA Canu, 1904
Family EXOCHELLIDAE Bassler, 1935

Colony encrusting or erect. Autozooids with umbonuloid frontal shield bordered by conspicuous marginal pores. Orifice with well developed peristome, incorporating one or more denticles on its inner, proximal edge; oral spines present. Avicularia adventitious. Ovicell present. Vertical walls with basal pore chambers or mural septula.

Exochella Jullien, 1888

Colony encrusting, unilaminar. Frontal wall of autozooids umbonuloid, imperforate other than for a single series of large, marginal pores. Orifice obscured in early ontogeny by a complex peristome, its lobed proximal edge corresponding with ridges on its inner face which delimit one or two narrow channels; at the lip of the peristome, these channels may close distally to form one or two distinct spiramina. Oral spines typically present. Avicularia adventitious, budded from marginal pores (frontal septula) proximo-lateral to orifice; one, two, or more per autozooid, usually with acuminate rostrum. Ovicell spherical, imperforate, sometimes partly immersed, not closed by autozooid operculum. Basal or mural pore chambers present.

Type species: *Mucronella tricuspis* Hincks, 1881c.

Exochella is distributed almost exclusively in the southern hemisphere. There are several Antarctic species, and a number of others from cold temperate or subantarctic waters of South America, the Southern Indian Ocean and New Zealand (Hayward, 1991). *E. conjuncta* Brown is the only species known to range into tropical waters.

Exochella conjuncta Brown (Fig. 13d)

Exochella conjuncta Brown, 1952: 294, figs 220-223.
Exochella conjuncta: Gordon, 1989b:30, pl.14, fig. A.

DESCRIPTION

Colony forming small, rounded patches. Autozooids oval to hexagonal, convex, separated by thickened ridges which become indistinct in later ontogeny; small, 0.35-0.4 by about 0.25mm.

Frontal wall with few, large, marginal pores; thickening steadily, becoming vitreous and smooth, with the boundaries of each autozooid marked only by the pronounced, rounded, marginal pores. Peristome with paired inner ridges, delimiting a single median channel, opening externally as an oval spiramen. Two short, distal, oral spines present in newly budded autozooids, obscured by development of peristome. One or two avicularia per autozooid, 0.13mm long, with slender, laterally-directed rostrum. Ovicell spherical, smooth, largely immersed and hidden in later ontogeny.

DISTRIBUTION

E. conjuncta was first described from Pliocene deposits of New Zealand (Brown, 1952), and subsequently shown to have a Recent distribution extending from the South Island of New Zealand to New South Wales (Gordon, 1989b). Its presence at Heron Island marks a considerable extension in its known range.

Family CELLEPORARIIDAE Harmer, 1957

Colony encrusting, multilaminar, massive or nodular; often erect, developing stout, irregular branched or lobed forms; or pisiform, encrusting erect substrata; or discoidal and unattached. Autozooids recumbent to erect, typically without regular orientation; frontal wall umbonuloid, with marginal pores. Orifice without a sinus, with or without one or more proximal denticles; oral spines present or absent. Avicularia adventitious, associated with orifice, and vicarious; typically polymorphic. Ovicells present.

Celleporaria Lamouroux, 1821

Colony encrusting, or erect and irregularly branched, or massive; multilaminar, developed by frontal budding of successive autozooid generations. Autozooids recumbent at growing margins, elsewhere suberect, with varying orientation. Frontal wall umbonuloid, with indistinct marginal pores. Oral spines typically present. Avicularia adventitious and vicarious, frequently polymorphic. Ovicell hyperstomial, small and spherical, imperforate.

Type species: *Cellepora cristata* Lamarck, 1816.

This genus is widely distributed in tropical and subtropical seas, with many species reported from shallow reef habitats. Colonies are often large, and conspicuously pigmented. Unfor-

unately, identification is often difficult. The taxonomy of *Celleporaria* is confused, at least partly because many species have still to be named, and a majority of described species are poorly known and have never been adequately illustrated.

***Celleporaria tridenticulata* (Busk)**
(Fig. 14b,c)

Cellepora tridenticulata Busk, 1881: 343, 344, 347, pl. 26, fig. 9; 1884: 198, pl. 29, fig. 3; pl. 35, fig. 17.
Celleporaria tridenticulata: Harmer, 1957: 670, pl. 42, figs 5-10; Gordon, 1984: 115, pl. 45, figs C-E.

DESCRIPTION

The aperture of *C. tridenticulata* bears three conspicuous denticles on its concave proximal border, which may be pointed, truncate, bifid, or even trifid. It has two (rarely three or four) slender, distal oral spines, and a median, proximal, suboral avicularium on a short umbonate cystid, with the oval rostrum acute to the orifice plane and facing laterally. Vicarious avicularia vary from 0.3 to 0.5 mm long, with a slender rostrum, slightly spatulate distally, with a finely serrate edge, and a stout crossbar, which lacks a columella.

DISTRIBUTION

Described originally from Torres Strait, this species has been recorded from throughout the Great Barrier Reef province, from New South Wales, Victoria and New Zealand. It is distributed through the Indo-Malaysian Archipelago, westwards to India, Sri Lanka and Mauritius. Canu & Bassler's (1930) record from the Galapagos Islands should perhaps be re-examined.

REMARKS

C. vagans (q.v.) also bears three, thin, pointed denticles on the proximal border of the orifice. It is distinguished from *C. tridenticulata* by its lack of oral spines; by its deeply notched peristome; and by its vicarious avicularium, which is more slender than that of *C. tridenticulata*, with a smooth edge to the rostrum and a distinct columella.

***Celleporaria aperta* ((Hincks))**
(Fig. 14d,e)

Schizoporella aperta Hincks, 1882: 126, pl. 5, fig. 3.

Celleporaria aperta: Harmer, 1957: 673 (in part); Winston & Heimberg, 1986: 32, figs 79-84.

DESCRIPTION

Colony multilaminar and nodular, but rather small, rarely occupying more than a few cm² of substratum. Recumbent autozooids commonly 0.5 × 0.3 mm, with convex, nodular frontal wall; marginal pores few, small and indistinct. Primary orifice wider than long, about 0.1 × 0.15 mm, the proximal border slightly concave, with a shallow, irregularly U-shaped sinus medially; condyles small, pointed, inconspicuous; typically with two, widely spaced, disto-lateral spines, and occasionally with a third, distally situated. Suboral avicularium characteristic: proximal to sinus, small, with oval rostrum, finely denticulate distally, 0.05 mm long; perpendicular to plane of orifice and facing laterally. Vicarious avicularia sporadic, rostrum commonly 0.2-0.3 mm long, parallel-sided, and rounded distally, or rather lanceolate with a tapered distal tip; crossbar stout, flattened. Ovicell shallow, imperforate, with finely nodular calcification.

REMARKS

Winston & Heimberg (1986) re-examined some of the material studied by Harmer (1957), and considered that he had confused several species of *Celleporaria* in his account of *C. aperta*.

DISTRIBUTION

C. aperta seems to be widely distributed in the western Pacific, from the South China Sea to Queensland, and throughout the East Indies, ranging to Sri Lanka and East Africa. Its reported occurrence from West Africa, Cape Verde Islands (Cook, 1968b, 1985) and the Caribbean should be regarded with caution until specimens from those regions have been examined by SEM.

***Celleporaria desperabilis* sp. nov.**
(Fig. 15c,f)

TYPE MATERIAL

HOLOTYPE: GH5228, Heron Island, Sin 14, 12 Apr 1972.

PARATYPE: GH5229, as for holotype.

ETYMOLOGY

Latin *despero*, *desperabilis*, hopeless.

DESCRIPTION

Colony forming a multilaminar, encrusting

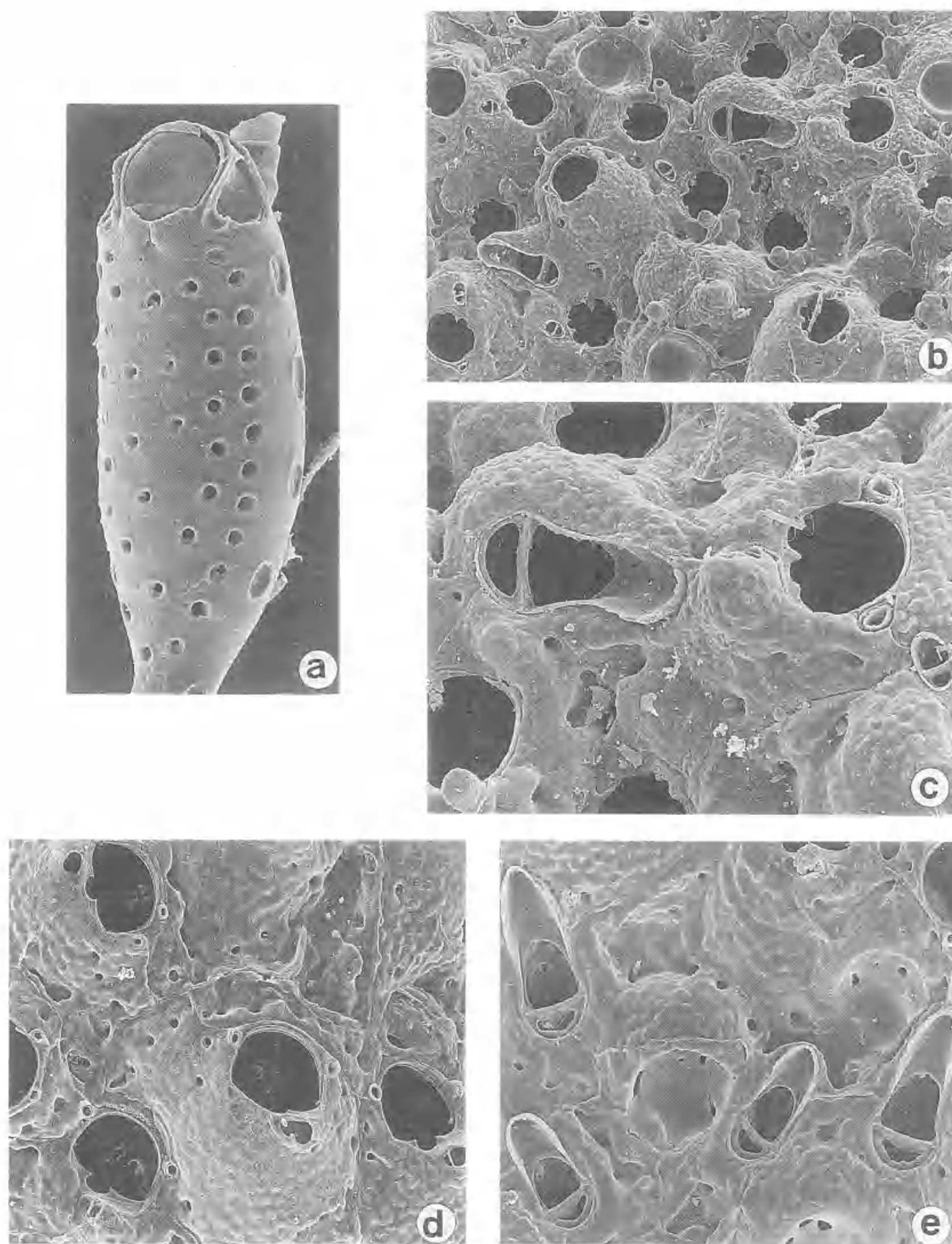


FIG. 14. a, *Vasignyella otophora*, $\times 120$. b, c, *Celleporaria tridenticulata*; b, $\times 50$; c, detail to show primary orifice and a vicarious avicularia, $\times 120$. d, e, *Celleporaria aperta*; d, $\times 85$; e, vicarious avicularia, $\times 95$.

sheet. Autozooids $0.6-0.7 \times 0.4-0.5$ mm; frontal wall convex, finely nodular or wrinkled, with few, relatively large, marginal pores. Primary orifice wider than long, about 0.12×0.17 mm, the proximal border gently concave, bearing three denticles within its edge: lateral denticles stout, pointed; median denticle variable, quadrate, or anvil-shaped, its free edge often notched or bifid, sometimes completely divided to give two separate, slender denticles. No oral spines. Peristome developing early in ontogeny, enclosing and obscuring proximal and lateral borders of orifice; a single median suboral avicularium, columnar, the rostrum perpendicular to plane of orifice, elongate triangular, about 0.15 mm long, with finely toothed distal edge; crossbar slender, with a conspicuous columella; apically, the avicularium is produced as a tapered umbo. Adjacent to the proximal end of the avicularium, the peristome is deeply notched. Tiny adventitious avicularia, with oval rostrum, often frequent along margins of autozooids. Vicarious avicularia rare, apparently absent from many colonies; small, rostrum 0.15-0.25 mm long, parallel-sided, deeply cupped distally. Ovicell a simple hemisphere, widely open frontally, lightly calcified, but thickening slightly in later ontogeny.

REMARKS

This species is distinguished from *C. tridenticulata* by its large, columnar suboral avicularium, deep peristome, and lack of oral spines. *C. vagans* (q.v.) has three thin, pointed denticles within the proximal edge of the orifice; its suboral avicularium is proportionately much smaller than that of *C. desperabilis*, and the ovicell larger, with a granular surface, and an asymmetrical aperture which may bear a small avicularium on its rim.

Celleporaria fusca (Busk) (Fig. 15a-d)

Celleporaria fusca Busk, 1854: 88, pl. 119, fig. 2; pl. 120, fig. 6.

Celleporaria fusca: Harmer, 1957: 680, pl. 43, figs 1-7.

DESCRIPTION

Colony forming massive, nodulated, multi-laminar sheets, often exceeding 25 cm^2 ; less frequently, developing erect, irregularly branching growths; deep purplish-brown in colour. Aperture about as wide as long, more or less D-shaped, the proximal border slightly concave, and arched

frontally. No oral spines. Peristomial thickening most pronounced proximally, incorporating a single medio-proximal avicularium, vertically orientated with respect to the aperture, its cystid produced apically as a stout, pointed umbo; rostrum facing laterally, small and oval (0.05 mm long), or longer (0.15-0.30 mm), with a strongly denticulate distal edge. Vicarious avicularia generally infrequent, but characteristic: rostrum slender, lanceolate, rounded distally and often with a slight lateral curve; 0.2-0.6 mm long. Ovicell spherical, imperforate, its orifice rim with an asymmetrical thickening which may include a small adventitious avicularium. Immediately below the avicularium the peristome rim bears a narrow notch, on the other side of which the rim is slightly thickened.

REMARKS

Winston & Heimberg (1986) indicated that Harmer's (1957) account of *C. fusca* was founded on a number of similar, deeply pigmented species, Harmer's figures, however, appear to represent true *C. fusca*. The type specimen (BMNH reg. no. 1854.11.15.180) is labelled 'pl. 119. Cape Capricorn' in Busk's hand, although the published type locality was given as Bass Strait. A second Busk collection specimen (BMNH 1899.7.1.4867A) is labelled 'Bass Strait'; both this and the type specimen are labelled 'R', for HMS Rattlesnake. A Hincks collection specimen from Bass Strait (BMNH 1899.5.1.1316), Torres Strait specimen figured by Harmer (1957) (BMNH 1963.9.8.11), and a Siboga specimen from Makassar (BMNH 1963.9.8.14 part) have all been compared with the two Busk collection specimens, and with the present series from Heron Island, and it is clear that they all represent a single species. On the basis of these specimens, *C. fusca* can be said to range along the entire east coast of Australia, from Bass Strait to Torres Strait, and into the Indo-Malaysian Archipelago. In view of Winston & Heimberg's (1986) account, the synonymy constructed by Harmer should be viewed with caution, until records from the Indian Ocean can be re-examined.

Celleporaria pigmentaria (Waters) (Fig. 16d,e)

Holoporella pigmentaria Waters, 1909: 163, pl. 15, figs 16-19; pl. 16, figs 9-16; pl. 17, figs 22, 23.

Celleporaria pigmentaria: Harmer, 1957: 684, pl. 43, fig. 8; text-fig. 58.

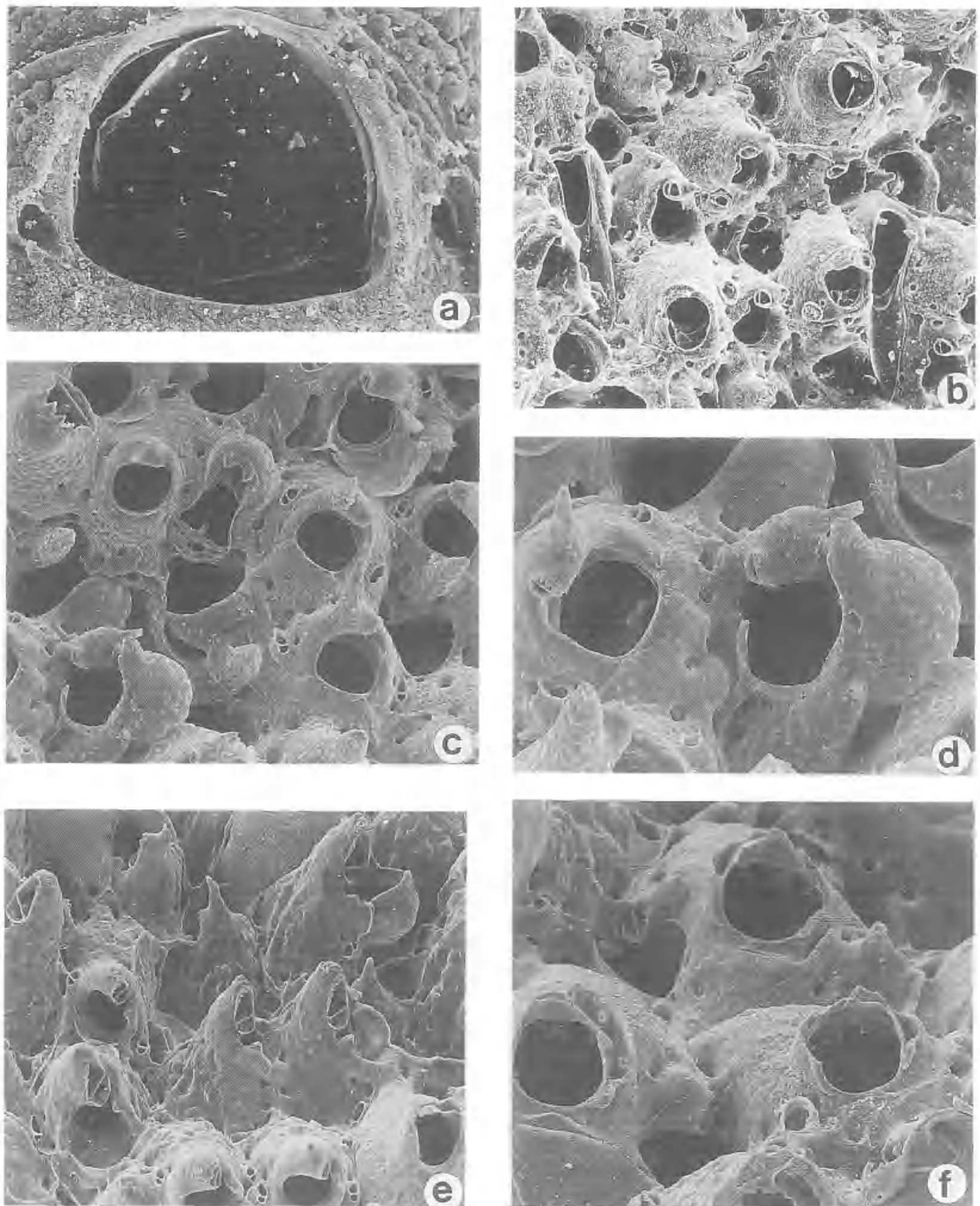


FIG. 15. a-d, *Celleporaria fusca*; a, primary orifice, $\times 290$; b, part of colony, with elongate vicarious avicularia, $\times 45$; c, part of colony, with spatulate vicarious avicularia, $\times 70$; d, detail to show ovicell, $\times 120$. e, f, *Celleporaria desperabilis*; e, $\times 55$; f, $\times 100$.

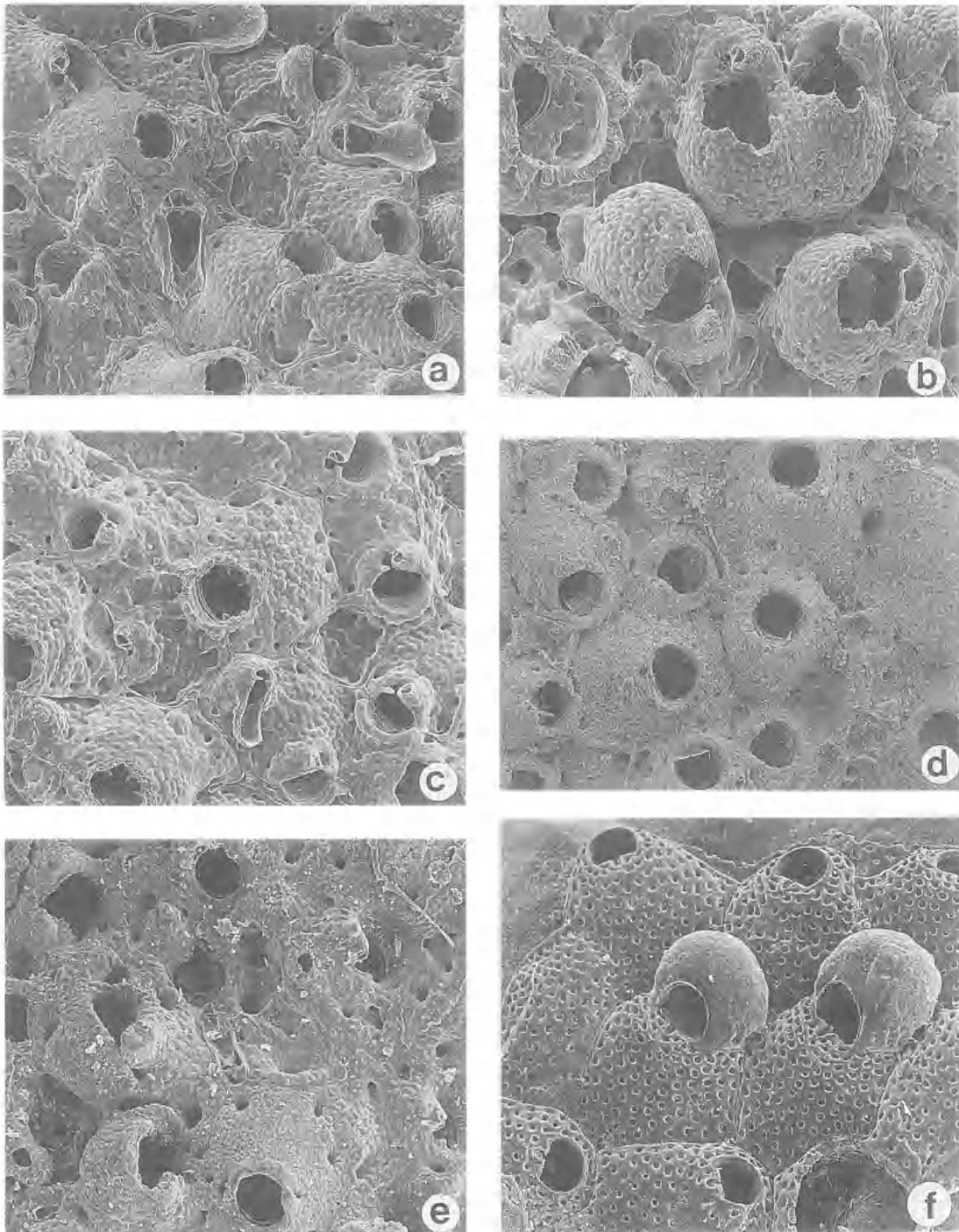


FIG. 16. a-c, *Celleporaria vagans*; a, $\times 45$; b, $\times 50$; c, $\times 45$. d,e, *Celleporaria pigmentaria*; d, $\times 45$; e, $\times 60$. f, *Arthropoma ceciliai*, $\times 50$.

DESCRIPTION

Colony multilaminar, nodular, occasionally developing stout, erect, branching forms, deep brown to black. Autozooids oval, strongly convex, thickly calcified; commonly $0.5-0.6 \times 0.4-0.5$ mm. Frontal wall coarsely nodular, with small, indistinct marginal pores. Aperture orbicular, slightly wider than long, its rim thickened but not especially prominent; a very small avicularium present mid-proximally, vertically orientated, with oval rostrum 0.05 mm long; adjacent to the avicularium the peristomial rim clearly notched. No oral spines. Vicarious avicularia rare, usually absent; rostrum narrowly scaphoid, 0.25 mm long, with incomplete crossbar. Peristomial avicularium occasionally giving rise to a stout, spiked mucro, which may be particularly accentuated among the oldest autozooids. Ovicell hemispherical, thickly calcified, inconspicuous.

REMARKS

This species was originally described from the Red Sea (Waters, 1909), and reported from a single Indonesian locality by Harmer (1957). The present material has been compared with the specimens from Ghardaqa and Sumbawa listed by Harmer, and with a specimen collected previously from Heron Island by L. Vail, and all seem to represent a single species.

***Celleporaria vagans* (Busk)**
(Fig. 16a-c)

Cellepora vagans Busk, 1881: 343; 1884: 198, pl. 29, fig. 10; pl. 35, fig. 11.

Celleporaria vagans: Harmer, 1957: 671, pl. 42, fig. 4; text-fig. 55.

DESCRIPTION

Colony forming a multilaminar, encrusting sheet. Autozooids $0.6-0.8 \times c.0.4$ mm; frontal wall convex, nodular and rugose, bordered by small but distinct marginal pores. Primary orifice wider than long, commonly 0.17×0.12 mm; proximal edge shallowly concave, with three thin, pointed denticles evenly spaced just within its rim. No oral spines. Peristome deep, developing in early ontogeny, enveloping lateral and proximal borders of orifice; a single median sub-oral avicularium, small, columnar, its apex produced as a short, pointed umbo; rostrum 0.1-0.2 mm long, oval, orientated vertically to orifice plane and directed laterally. Peristome rim deeply notched adjacent to the proximal end of the avicularium; in later ontogeny a process extend-

ing from the peristome rim eventually fuses with the opposite rim, below the avicularium, to delimit a rounded spiramen. Vicarious avicularia infrequent, variable in length, but reaching 0.6 mm; elongate, narrowest medially, spatulate and slightly cupped distally. Ovicell more than a hemisphere, overarched the primary orifice, surface finely granular, with a few indistinct perforations; its aperture irregularly triangular, the rim often peaked medially, and bearing a small avicularium in later ontogeny.

DISTRIBUTION

C. vagans is known from Hawaii, Torres Strait, Indonesia, and the eastern Indian Ocean, but from relatively few specimens. Busk's (1881, 1884) material from Crozet Island perhaps represents a different species, and requires re-examination.

Superfamily SCHIZOPORELOIDEA Jullien, 1883

Family HIPPOPODINIDAE Levinsen, 1909

Colony encrusting. Autozooids with cryptocystidean frontal wall, evenly perforated. Orifice more or less bell-shaped: arched distally, shallowly concave proximally, with prominent lateral condyles. No oral spines. Avicularia adventitious, typically associated with orifice. Ovicell partly or wholly immersed, perforated, closed by autozoid operculum.

***Hippopodina* Levinsen, 1909**

Colony encrusting. Frontal wall of autozoid with cryptocystidean development, perforated by numerous, closely spaced, small pores. Primary orifice bell-shaped; proximal border shallowly concave between distinct lateral condyles; no oral spines. Avicularia adventitious. Ovicell partially immersed in next autozoid, finely perforate, closed by autozoidal operculum. Vertical walls of autozooids with numerous, small, uniporous septula.

Type species: *Lepralia feegeensis* Busk, 1884.

***Hippopodina feegeensis* (Busk)**
(Fig. 17a)

Lepralia feegeensis Busk, 1884: 144, pl. 22, figs 9, 9a, 9b.

Hippopodina feegeensis: Harmer, 1957: 974, pl. 67, figs 7-9; Winston & Heimberg, 1986: 16, figs 28-30.

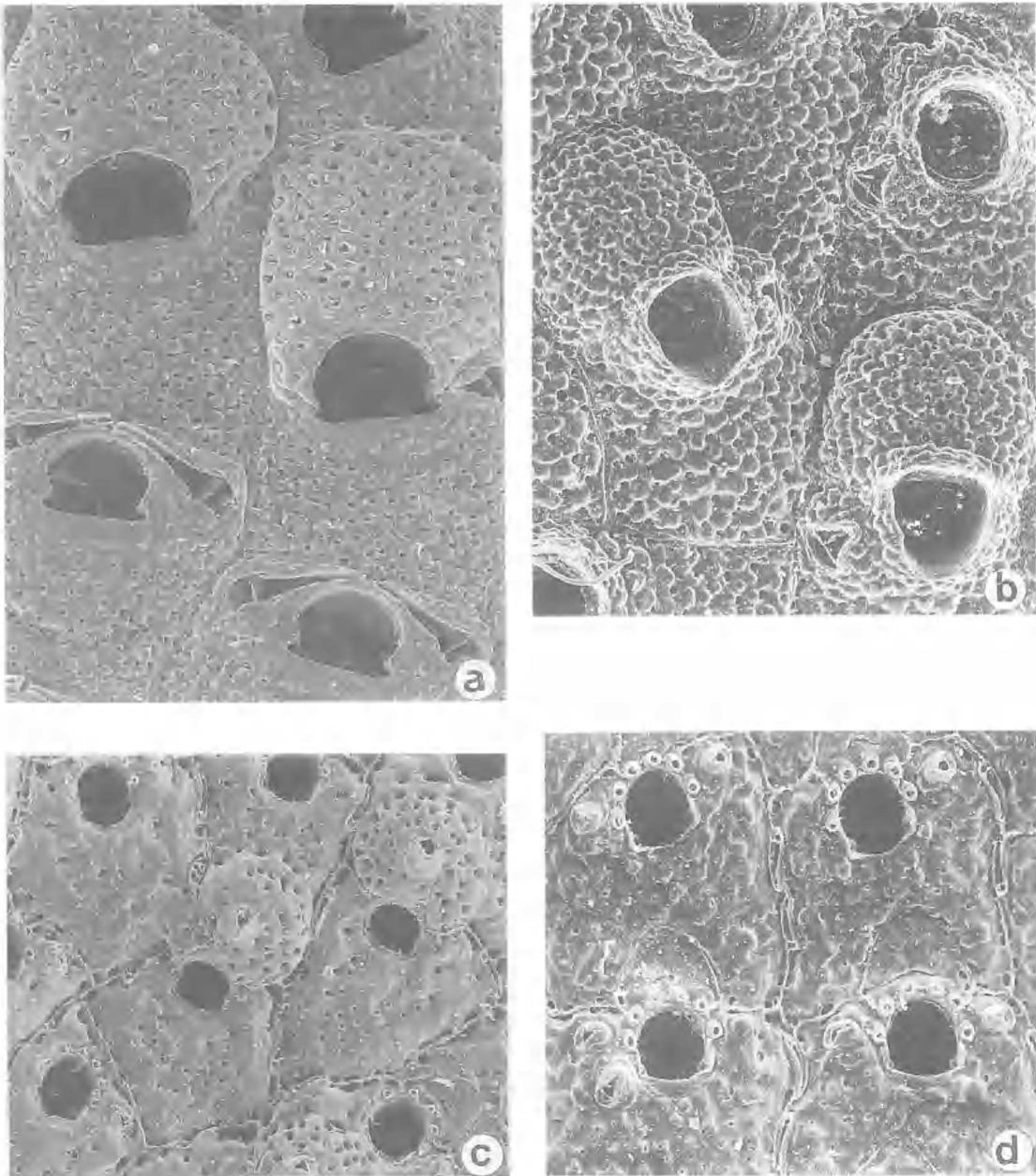


FIG. 17. a, *Hippopodina feegeensis*, $\times 55$. b, *Cosciniopsis lonchaea*, $\times 50$. c, d, *Thornelya perarmata*; c, $\times 60$; d, $\times 85$.

DESCRIPTION

Colonies forming thin, very extensive, light yellowish-brown, unilaminar sheets, glistening when dried. Autozooids oval to hexagonal, convex, separated by distinct grooves, lightly calcified; commonly $0.75-0.9 \times 0.5-0.6$ mm. Primary orifice longer than wide, bell-shaped, with sharp, down-curved condyles. Frontal wall

pearly or nodular, with numerous, densely-spaced, small pores, giving a speckled appearance at low magnification. Avicularia single or paired, disto-lateral to orifice; slender, acuminate rostrum directed medially, close to the distal border of the orifice.

Ovicell elongate oval, very prominent, densely perforated, with arched aperture.

REMARKS

H. feegeensis has a pan-tropical distribution in shallow waters. It forms broad flat sheets, often exceeding 100cm², on all kinds of hard substrata, and may be the most abundant bryozoan occurring on coral rubble in reef flat habitats. It is also often the primary colonising species on artificial substrata. It was common in 11 of the samples from Heron Island reported here.

Cosciniopsis Canu & Bassler, 1927

Colony encrusting, often strikingly pigmented. Autozooids large, robust, with thickly calcified, tuberculate frontal wall, pierced by numerous small pores. Primary orifice elongate-oval or bell-shaped, the proximal border broadly concave, between distinct lateral condyles. No oral spines. A well developed peristome typically present. Adventitious avicularia developed lateral to orifice, single or paired; lacking in some species. Ovicell hyperstomial, globular, with tuberculate calcification pierced by numerous small pores; closed by autozooid operculum.

Type species: *Cosciniopsis coelatus* Canu & Bassler, 1927.

Cosciniopsis lonchaea (Busk)
(Fig. 17b)

Lepralia lonchaea Busk, 1884: 146, text-fig. 43.

Cosciniopsis lonchaea: Harmer, 1957: 1083, pl. 72, figs 16, 17, 19, 20.

DESCRIPTION

Colony forming small, unilaminar patches. Autozooids oval to hexagonal, strongly convex, separated by deep grooves; 0.7-1.0 × c.0.6mm. Primary orifice elongate-oval, the proximal edge with thickened, concave rim; condyles small and rounded; enveloped distally and laterally by a thin, raised peristome. Frontal calcification strikingly tuberculate, the tiny pores just visible between the tubercles. Most autozooids with a single, lateral-oral, avicularium; its blister-like cystid closely applied to the peristome, the acuminate rostrum acute to frontal plane, directed disto-medially towards the orifice. In some autozooids the lateral-oral avicularium is paired, one each side of the orifice; in others an identical avicularium occurs on the distal edge of the peristome, with the rostrum perpendicular to the frontal plane, directed towards the orifice of the autozooid. Ovicell slightly wider than long,

globular, with tuberculate calcification and fine perforation identical to that of the autozooid.

DISTRIBUTION

Described originally from New Guinea. *C. lonchaea* has been reported from Torres Strait and South China Sea by Kirkpatrick (1890a,b) and from Indonesia by Harmer (1957). Waters (1909) recorded it from Sudan, while Harmer's (1957) synonymy of *Lepralia vestita* Hincks extends its range to Tahiti and Hawaii.

Thornelya Harmer, 1957

Colony encrusting, unilaminar. Primary orifice of autozooid bell-shaped, with broad, concave proximal border; condyles distinct; oral spines present. Frontal wall with large marginal pores, and small, scattered frontal pores. Adventitious avicularia present, often numerous, one to four per autozooid, most usually associated with the orifice or the ovicell, generally rather small. Ovicell recumbent on next autozooid, prominent, irregularly rounded, surface densely perforated, sutured, often bearing avicularia; closed by autozooid operculum.

Type species: *Lepralia ceylonica* Thornely, 1905.

Thornelya perarmata Harmer, 1957
(Fig. 17c,d)

Thornelya perarmata Harmer, 1957: 1105, pl. 73, figs 6-8.

DESCRIPTION

Colony forming very small, unilaminar patches. Autozooids irregularly rectangular to hexagonal, rather flat, separated by thickened sutures; 0.4-0.5 × 0.3-0.35mm. Primary orifice 0.12mm long, with six spines in a distal arc; condyles rounded, distinct. Frontal wall smoothly calcified, nodular; with 10-30 small pores centrally, and a single series of larger, elongate oval marginal pores. Avicularium single or paired, lateral to orifice; rostrum triangular, 0.1mm long, acute to frontal plane, directed towards orifice; one or two, occasionally more, avicularia developing in later ontogeny on distal edge of orifice, with rostrum directed towards it; additional avicularia developed along lateral margins of autozooids. Ovicell about as wide as long, prominent, with densely punctured, nodular surface; a single avicularium present on frontal surface, with rostrum proximally directed.

DISTRIBUTION

This species was described by Harmer (1957) from 141m off Waigeo Island, northwest New Guinea. It has not been recorded previously from the Great Barrier Reef, or from reef flat habitats. It seems to be common at Heron Island, and occurred in seven of the samples studied.

Family HIPPOPORINIDAE Brown, 1952

Colony encrusting; or erect with an encrusting base. Autozooids with regularly perforated frontal wall. Primary orifice shallowly concave proximally, or distinctly sinuate, with conspicuous condyles; no oral spines. Avicularia adventitious. Ovicell typically large, inflated, often sutured; in some genera brooding autozooids with large, dimorphic orifice.

Calypotheca Harmer, 1957

Colony encrusting; sheet-like; or erect, bilaminate, plate-like. Frontal wall of autozooids densely perforated. Primary orifice sinuate, or with evenly concave proximal edge; dimorphic, typically larger and broader in brooding autozooids. Avicularia typically small, adventitious, lateral oral or sutural; rarely, vicarious; or absent. Ovicell large and conspicuous, perforated, closed by autozoid operculum.

Type species: *Schizoporella nivea* var. *wasinensis* Waters, 1913.

Calypotheca tenuata Harmer
(Fig. 18b,c)

Calypotheca tenuata Harmer, 1957: 1016, pl. 68, figs 16, 17.

DESCRIPTION

Colony developing extensive, multilaminar sheets. Autozooids oval to hexagonal or irregularly polygonal, convex, separated by thin, raised sutures; commonly $0.6-0.7 \times 0.5$ mm. Primary orifice slightly wider than long, proximal border shallowly concave between knob-like proximo-lateral condyles; with a low, nodular peristome developing in later ontogeny. Frontal wall thick, densely and evenly perforated by regular, round pores, with nodular calcification between. Ovicell partly immersed in distally succeeding autozoid, wider than long, rather flattened frontally, with a coarsely nodular surface perforated by irregular pores. Avicularia sparse, developed on lateral margin of autozoid,

proximal to orifice, directed medially and reaching midpoint of frontal wall; rostrum slender, acuminate, 0.35 mm long.

DISTRIBUTION

C. tenuata was known only from Indonesia, the Loyalty Islands and Sri Lanka; Heron Island provides the first Australian record.

Calypotheca thornelyae Dumont
(Fig. 18a)

Lepralia subimmersa: Thornely, 1905: 122.

[not] *Lepralia subimmersa* MacGillivray, 1879: 23, pl 35, fig. 5.

Calypotheca thornelyae Dumont, 1981: 625

DESCRIPTION

Colony forming extensive, unilaminar or multilaminar, light reddish-brown sheets. Autozooids rectangular, hexagonal or irregularly polygonal, convex, separated by distinct sutures; $0.5-0.75 \times 0.3-0.5$ mm. Primary orifice wider than long, proximal border shallowly and evenly concave between low, rounded, proximo-lateral condyles. Frontal wall thick, finely nodular, evenly perforated by numerous, small, round pores; a low, crenulate, peristomial rim characteristically present proximal to the orifice. Ovicell prominent, domed, occupying most of the frontal wall of the distally succeeding autozoid; calcification and perforation identical to that of autozoid frontal wall; orifice of brooding zoid shorter than that of autozoid, with more shallowly concave proximal edge. Adventitious avicularia sporadic, infrequent; 0.1 mm long, with slender, acuminate rostrum; single or paired, most usually situated proximo-lateral to orifice, medially directed, occasionally budded along the lateral margins of autozooids in later ontogeny.

REMARKS

Thornely's (1905) two specimens of '*Lepralia subimmersa*' from Sri Lanka appear to be the only known material of this species, prior to its collection from Heron Island; one of the specimens was designated lectotype of *Calypotheca thornelyae* by Dumont (1981). Both specimens have been compared with the Heron Island material, and there is no doubt that the two sets are conspecific. *Calypotheca subimmersa* (MacGillivray) is presently known only from the southern coasts of Australia.

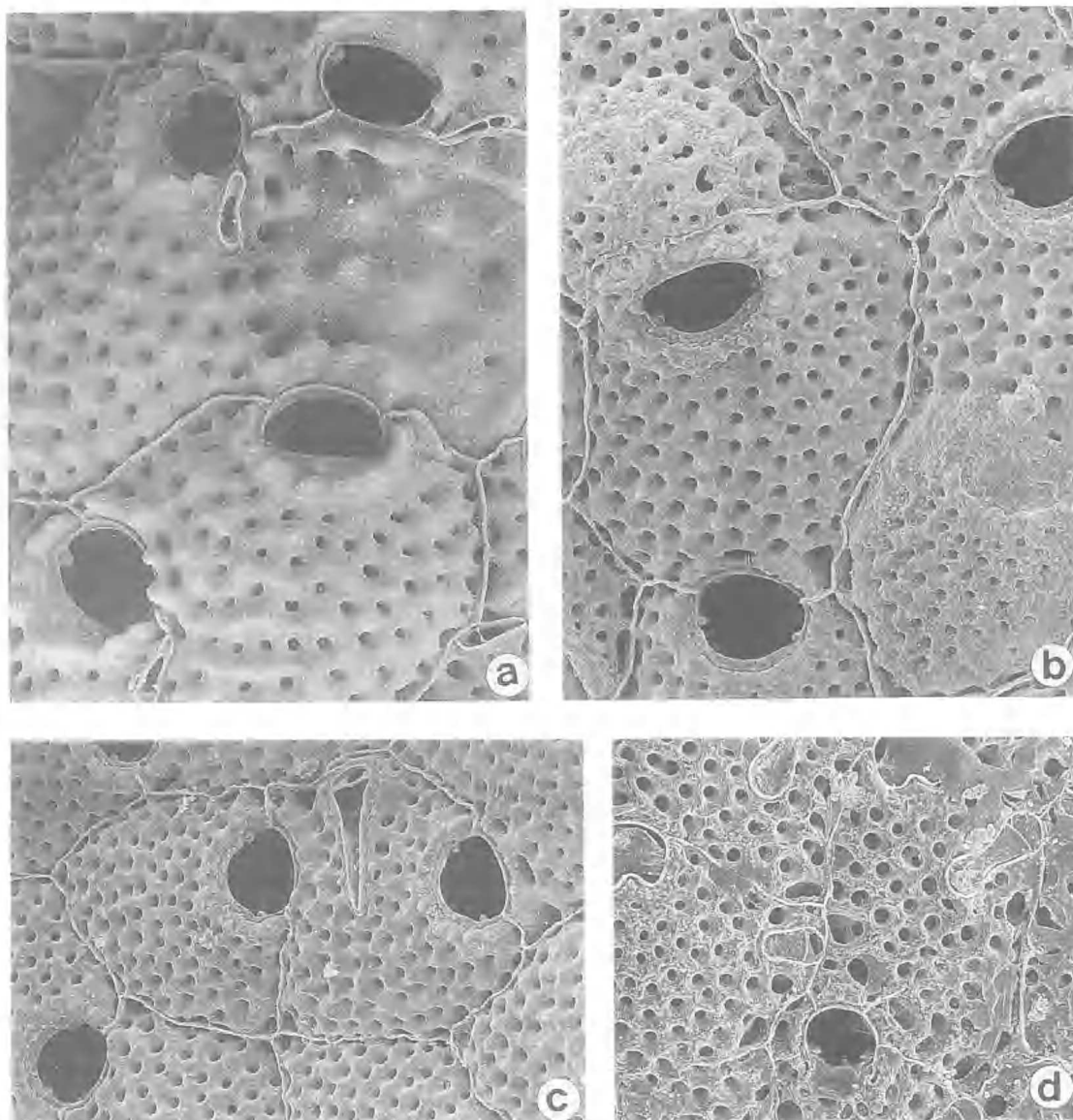


FIG. 18. a, *Calyptotheca thornelyae*, $\times 90$. b, c, *Calyptotheca tenuata*; b, $\times 70$; c, $\times 60$; d, *Emballothea pacifica*, $\times 70$.

***Emballothea* Levinsen, 1909**

Colony encrusting. Autozooids with evenly perforated frontal wall. Primary orifice shallowly concave proximally, or distinctly sinuate; with well-marked condyles; dimorphic, larger and broader in brooding autozooids. No oral spines. Avicularia adventitious; or absent. Ovicells large, inflated, sutured; regularly porous.

Type species: *Eschara quadrata* MacGillivray, 1880.

***Emballothea pacifica* Harmer
(Fig. 18d)**

Emballothea pacifica Harmer, 1957: 1088, pl. 67, figs 3-5.

DESCRIPTION

Colony an encrusting, multilaminar sheet. Autozooids rectangular to irregularly polygonal, convex, separated by distinct sutures. Primary orifice wider than long, its proximal border with

a rounded-triangular median process; with large, downcurved lateral condyles. Frontal wall thick, coarsely granular, perforated by large, irregular pores, which tend to fuse in later ontogenetic thickening. Ovicell prominent, obscuring much of distally succeeding autozoid, as wide as long, surface granular and coarsely perforated, and typically crossed by sutures; the orifice of ovicelled autozooids is broader than that of ordinary autozooids, with a shallowly concave proximal edge. Avicularia situated proximo-lateral to orifice, directed proximo-medially; of variable length, up to 0.3mm long; the smallest with a semielliptical mandible, the largest distinctly spoon-shaped.

DISTRIBUTION

Previously from isolated localities in the western Pacific, from the South China Sea to Torres Strait.

Robertsonidra Osburn, 1952

Colony encrusting. Autozooids with tuberculate frontal wall, bordered by conspicuous marginal pores. Primary orifice with proximal sinus, frequently with a pronounced lateral suboral umbo; spines present or absent. Avicularia adventitious. Ovicell hyperstomial, closed by autozoid operculum; surface tuberculate, with minute perforations. Vertical walls with very small uniporous septula; basal walls typically raised above the substratum on stout, projecting processes.

Type species: *Schizoporella oligopus* Robertson, 1908.

Robertsonidra argentea (Hincks) (Fig. 19b)

Schizoporella argentea Hincks, 1881b: 158, pl. 9, figs 6, 6a.

Rhamphostomella argentea: Harmer, 1957: 1102 [partim].

[not] *Robertsonidra argentea*: Powell, 1967: 169.

Colony a small, yellowish-white patch; unilaminar. Autozooids oval to broadly hexagonal, convex, separated by distinct sutures; 0.6–0.75 × 0.4–0.5mm. Primary orifice about as long as wide; proximal edge deeply, symmetrically concave, lacking condyles; two or three, thin, evanescent spines present in early ontogeny; frequently a short, asymmetrically-placed suboral umbo. Frontal wall regularly tuberculate,

with a single row of round marginal pores. Avicularia dimorphic, one or both types present on a single autozoid, some autozooids without either; lateral-suboral, acute to frontal plane, laterally directed, with short, hooked rostrum, or normal to frontal plane, proximo-laterally directed, with elongate triangular rostrum. Ovicell spherical, regularly tuberculate, with minute perforations.

OCCURRENCE

A single specimen collected from Heron Island, Stn 23, encrusting coral rock, constitutes the first Australian record.

REMARKS

Harmer's (1957) account of *R. argentea* was based on several different species, and there is no indication that he examined either the type specimen (BMNH reg.no. 1899.5.1.970, loc. 'Africa') or material of the genus type, *Schizoporella oligopus* Robertson, which he placed in the synonymy of *R. argentea*. Two of the Siboga specimens listed by Harmer (1957:1101) have been compared with the type specimen of *R. argentea* and found to represent two different, undescribed, species of *Robertsonidra*. Specimen 399D (Stn 164, BMNH reg.no. 1975.7.24.22) has a pear-shaped orifice with three distal oral spines and a disto-laterally orientated, lateral suboral avicularium, with an elongate triangular rostrum; the autozooids are only loosely coherent. Specimen 108F (Stn 144, BMNH reg.no. 1975.2.24.14) has a transversely oval orifice with a distinct U-shaped sinus, lacks spines, and has a distally-directed, lateral-suboral avicularium with a short, broadly triangular rostrum. Powell's (1967) figure of '*R. argentea*' from the southern Red Sea depicts yet another species of *Robertsonidra*, *R. oligopus*, which is known from the Galapagos Islands and Southern California is almost certainly distinct from *R. argentea*, and from any of the other species discussed here. The type locality of *R. argentea* is unknown, although its habitat, 'on coral', suggests it lies somewhere on the East African coast.

Robertsonidra novella sp. nov. (Fig. 19a)

TYPE MATERIAL

HOLOTYPE: GH5230, Heron Island, Stn 22, 15 Apr 1972.

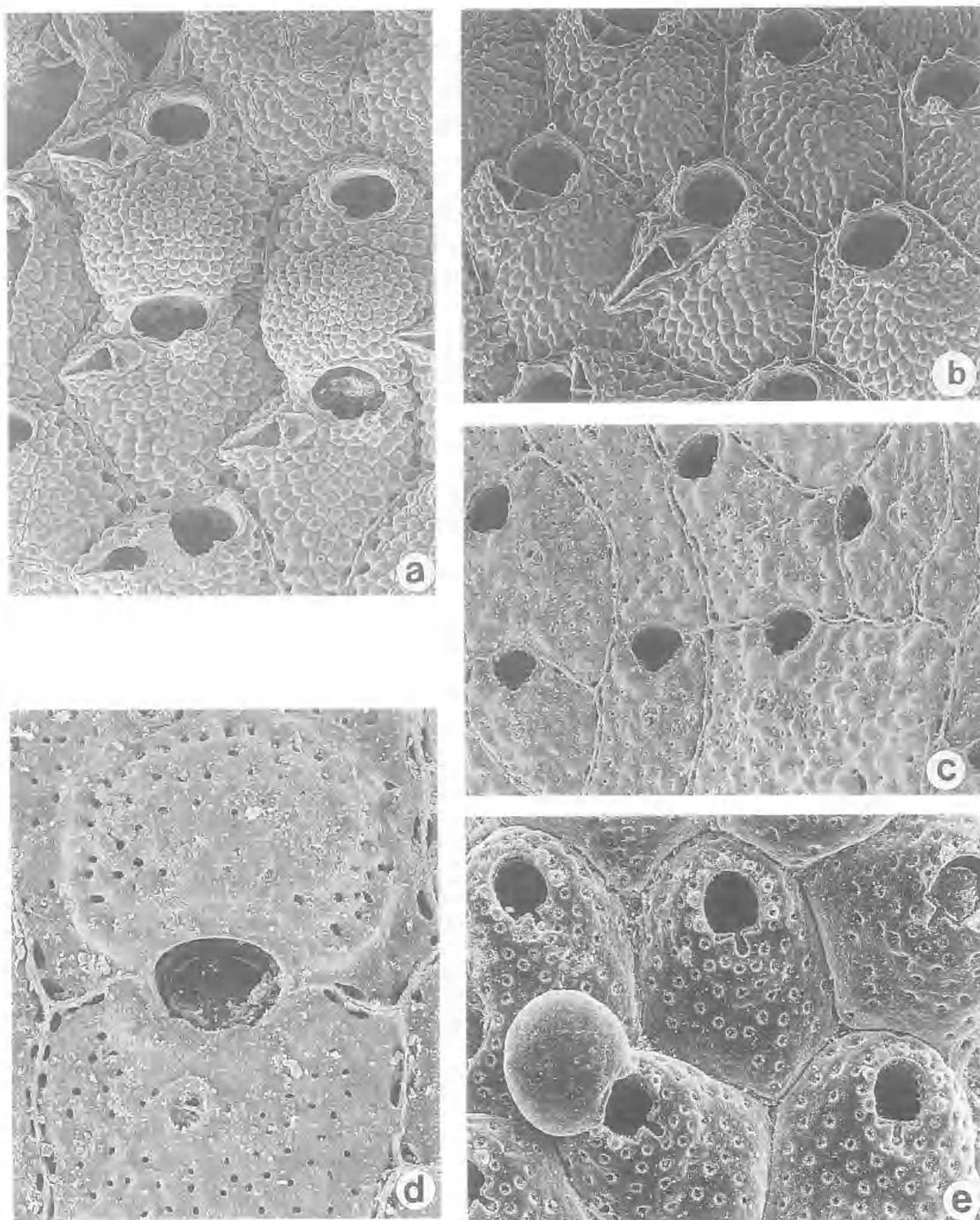


FIG. 19. a, *Robertsonidra novella*, $\times 60$. b, *Robertsonidra argentea*, $\times 60$. c,d, *Schizomavella inclusa*; c, $\times 70$; d, $\times 140$. e, *Phonicosia circinata*, $\times 70$.

ETYMOLOGY

Latin *novella*, diminutive of *novus*, new.

DESCRIPTION

Colony forming small, silvery, unilaminar patches. Autozooids oval to hexagonal, strongly convex, separated by distinct grooves; $0.5\text{--}0.6 \times 0.35\text{--}0.4\text{ mm}$. Primary orifice transversely oval, proximal border with a short, U-shaped sinus flanked by small condyles; one or two short, evanescent spines present distally, their bases persisting especially in ovicelled autozooids; a short umbo situated lateral to the sinus in many autozooids. Frontal wall regularly tuberculate, glistening under low magnification, with a single series of round marginal pores. Avicularia sporadic, lateral suboral; rostrum elongate triangular, directed proximo-laterally. In some autozooids a second, shorter avicularium occurs lateral to the sinus, with the rostrum acute to frontal plane and laterally directed. Ovicell slightly wider than long, globular, the surface tuberculate, with minute perforations between the tubercles.

REMARKS

This species is distinguished from *R. argentea* by its oval orifice, which has a distinct proximal sinus bounded by small condyles. It was present in three of the Heron Island samples.

Family SCHIZOPORELLIDAE Jullien, 1883

Colony encrusting or erect. Autozooids with cryptocystidean frontal wall; evenly perforated or with marginal pores only. Primary orifice typically with distinct proximal sinus and conspicuous condyles; oral spines present or absent. Avicularia adventitious and/or vicarious or interzooidal; or absent. Ovicells present. Vertical walls with basal pore chambers or mural septula.

Schizomavella Canu & Bassler, 1917

Colony encrusting. Frontal wall of autozooid with regularly distributed perforations. Primary orifice with distinct sinus and well-marked condyles; oral spines present or absent. Avicularia adventitious, typically suboral, but also lateral-oral, or frontal; dimorphic in some species. Ovicell hyperstomial, variably perforate, closed by autozooidal operculum. Vertical walls with small septula.

Type species: *Lepralia auriculata* Hussall, 1842.

Schizomavella inclusa (Thomely)
(Fig. 19c,d)

Schizoporella inclusa Thomely, 1906: 450.

Schizomavella inclusa: Harmer, 1957: 1028, pl. 66, figs 4, 6, 7; Winston & Heimberg, 1986: 18, figs 43, 44.

DESCRIPTION

Colony forming thin, flat encrustations. Autozooids irregularly rectangular, flat, separated by distinct sutures; $0.35\text{--}0.5 \times 0.25\text{--}0.35\text{ mm}$. Primary orifice as wide as long, broadest distally and appearing pear-shaped, with a deep, U-shaped proximal sinus below short, distinct condyles. No oral spines. Frontal wall thick and vitreous, irregularly nodular, with numerous, small, round pores; marginal pores larger and more distinct. Avicularium suboral, proximally directed, 0.05 mm long, with oval or bluntly triangular rostrum. A dimorphic avicularium, with enlarged, spatulate mandible was described by Harmer (1957). Ovicell wider than long, partially immersed; with numerous small pores, most densely distributed around edges.

DISTRIBUTION

S. inclusa has been described from scattered localities, from Madagascar, Mauritius and Sri Lanka, to Indonesia, New Guinea and New Britain. Harmer (1957) recorded a specimen from the Red Sea, but it has not been recorded previously, with certainty, from Australian seas.

Arthropoma Levinsen, 1909

Colony encrusting. Autozooid with evenly perforated frontal wall. Primary orifice with narrow medio-proximal sinus; operculum articulated. No oral spines. Avicularia absent. Ovicell prominent, imperforate, closed by autozooid operculum. Vertical walls with large, multiporous septula. Ancestrula identical to later autozooids.

Type species: *Flustra cecilia* Audouin, 1826.

Arthropoma cecilia (Audouin)
(Fig. 16f)

Flustra cecilia Audouin, 1826: 239; Savigny pl. 8, fig. 3.

Arthropoma cecilia: Harmer, 1957: 1001, pl. 72, fig. 23, text-fig. 108; Gordon, 1984: 85, pl. 30, fig. A.

DESCRIPTION

Colony forming small, glistening, white patches; usually unilaminar. Autozooids lightly calcified, strongly convex, with densely perforated frontal wall; commonly $0.5-0.7 \times 0.5$ mm. Primary orifice slightly wider than long, D-shaped, with a very narrow, medio-proximal sinus. No avicularia, although Harmer (1957) reports a polymorph with an operculum twice the size of that of ordinary autozooids. Ovicell prominent, convex, smoothly calcified, opaque white.

DISTRIBUTION

A. cecilia is widespread and common in all shallow, tropical, subtropical and warm temperate seas. It has been reported previously from reef habitats in the Caribbean, the Indian Ocean, the East Indies and the GBR.

Phonicosia Jullien, 1888

Colony encrusting. Autozoid frontal wall with conspicuous marginal pores, and sometimes with additional pores proximo-lateral to orifice, but with central area usually imperforate. Primary orifice with proximal sinus; operculum articulated; distal oral spines present. Adventitious avicularia occur sporadically. Ovicell prominent; ectoecium membranous; entoecium calcified; imperforate, except for small basal pores around periphery; not closed by autozoid operculum. Basal pore chambers present.

Type species: *Phonicosia jousseaumei* Jullien, 1888 [= *Lepralia circinata* MacGillivray, 1869].

Phonicosia circinata (MacGillivray)
(Fig. 19c)

Lepralia circinata MacGillivray, 1869: 134.

Arthropoma circinatum: Harmer, 1957: 1003, pl. 72, figs 29-30; Hayward & Cook, 1983: 69, fig. 17c.

Phonicosia circinata: Gordon, 1984: 87, pl. 30, figs E,F; 1989: 46.

DESCRIPTION

This distinctive species is readily recognized by its D-shaped orifice, with slit-like sinus and broad, denticulate condyles, surrounded by eight or nine spines.

DISTRIBUTION

P. circinata has a wide geographical distribution, ranging throughout the western Pacific Ocean, from Japan to New Zealand, eastwards to

South Africa, Tristan da Cunha, the Patagonian Shelf and Tierra del Fuego; also at Marion Island and Kerguelen.

REMARKS

In some populations a large adventitious avicularium occurs proximal to the sinus, and the density and distribution of frontal wall pores also varies greatly. However, these variations may be observed over a relatively small geographic distance, and perhaps even within single populations.

Escharina Milne-Edwards, 1836

Colony encrusting or erect. Frontal wall of autozooids with distinct marginal pores, and evenly scattered, minute perforations. Primary orifice with well marked sinus; oral spines present. Avicularia adventitious or interzoidial. Ovicell hyperstomial, imperforate, closed by autozoid operculum. Small basal pore chambers present.

Type species: *Eschara vulgaris* Moll, 1803.

Escharina pesanseri (Smitt)

Hippothoa pesanseri Smitt, 1873: 43, pl. 7, figs 159, 160.

Escharina pesanseri: Harmer, 1957: 998, pl. 67, figs 12-14, 18, 19; Gordon, 1984: 84, pl. 29, figs A, B.

DESCRIPTION

Colony encrusting, forming small rounded patches; rather inconspicuous. Autozooids oval, convex; about 0.8×0.5 mm; frontal wall finely granular, fine perforations revealed only by high magnification. Primary orifice longer than wide, with a narrow, slit-like sinus between broad condyles; with eight or nine stout distal oral spines, and a low proximal peristomial rim. Avicularia paired, lateral to orifice, with distinctive, duck's foot-shaped mandibles distally directed. Ovicell relatively small, wider than long, with a transverse frontal ridge; six spines only in ovicelled autozooids.

DISTRIBUTION

E. pesanseri has a circumtropical distribution in shallow water, and occurs commonly in reef habitats.

Stylopoma Canu & Bassler, 1920

Colony encrusting, multilaminar, developing

extensive nodular growths. Frontal wall of autozooids evenly perforated by small pores, with a marginal series of larger pores. Primary orifice with well developed condyles and deep proximal sinus; no oral spines. Avicularia adventitious, small, and vicarious, large. Ovicell globular, prominent, perforated; overhanging and eventually occluding orifice of brooding autozoid. Vertical walls with numerous, small, recessed septula.

Type species: *Eschara spongites* Pallas, 1766.

The genus *Stylopoma* has a pantropical distribution in shallow, coastal waters, and most species described seem to be commonly found in reef habitats. Most are brightly pigmented.

***Stylopoma duboisii* (Audouin)**
(Fig. 20a,b)

Flustra?duboisii Audouin, 1826: 239; 1828: 66; Savigny pl. 8, figs 41, 42.

Stylopoma duboisii: Harmer, 1957: 1033, pl. 74, figs 1-7; Winston & Heimberg, 1986: 20, figs 45-57.

DESCRIPTION

Autozooids irregularly polygonal, rather flat, separated by distinct sutures; $0.5-0.6 \times 0.35-0.45$ mm. Primary orifice wider than long, D-shaped, the straight proximal border with a slit-like median sinus; condyles low and broad, occupying whole of proximal border on each side of sinus, distal edges finely toothed. Frontal wall densely perforated by small round pores, and with a single series of larger marginal pores; becoming coarsely nodular in later ontogeny. Typically, a single, small avicularium proximo-lateral to orifice, acute to frontal plane, disto-laterally directed; 0.05 mm long, with short, triangular mandible. Additional avicularia may be budded in later ontogeny, especially in brooding autozooids, and most usually in proximity to the orifice. Vicarious avicularia infrequent, as large as autozooids, with broadly spatulate mandible. Ovicells globular, prominent, 0.5 mm diameter, occupying the frontal surface of several adjacent autozooids; densely porous, with the aperture overhanging and obscuring the orifice of the maternal autozoid.

DISTRIBUTION

This species is common in shallow waters throughout Malaysia and Indonesia, and on the coasts of New Guinea and Queensland. It ranges westwards to Sri Lanka and the Red Sea, and was reported from West Africa by Cook (1968b).

Seven of the Heron Island samples contained large colonies of *S. duboisii*.

***Stylopoma thornelyae* Livingstone**
(Fig. 20c)

Schizoporella viridis var. *thornelyi* Livingstone, 1926: 84, pl. 8, figs 8, 9.

DESCRIPTION

Autozooids rectangular to polygonal, convex, separated by distinct sutures; $0.6-0.8 \times 0.35-0.5$ mm. Primary orifice about as wide as long, proximal border with a broad V-shaped sinus occupying about half its width; condyles rectangular, distinct. Frontal wall densely perforated by small, evenly distributed pores, each in a shallow pit. A single, small adventitious avicularium present on many autozooids, lateral to sinus; rostrum 0.08 mm long, acute to frontal plane, distally directed, supporting a short, triangular mandible. Vicarious avicularia sporadic, slightly smaller than autozooids, with waisted, spatulate rostrum.

DISTRIBUTION

This species is known with certainty only from the Great Barrier Reef, although part of the Indonesian material described by Harmer (1957) as *S. parviporosum* Canu & Bassler may represent *S. thornelyae*.

***Stylopoma viride* (Thornely)**
(Fig. 20d)

Schizoporella viridis Thornely, 1905: 116, fig. 3.

Stylopoma viride: Harmer, 1957: 1036, pl. 74, figs 8-13; Winston & Heimberg, 1986: 21, figs 48-50.

DESCRIPTION

Autozooids rectangular, diamond-shaped or polygonal, convex, separated by distinct sutures; $0.8-1.2 \times 0.5-0.6$ mm. Primary orifice orbicular, with a deep V-shaped sinus occupying two-thirds of the proximal width; condyles small, knob-like. Frontal wall densely perforated by small, round pores, the marginal series slightly larger and more distinct; calcification thick, forming raised, nodular ridges between the pores. Majority of autozooids with characteristic disto-lateral adventitious avicularium; rostrum slender, pointed, 0.35 mm long, extending disto-medially above the orifice. A smaller suboral avicularium present in many autozooids, adjacent to sinus, with varying orientation. Vicarious avicularia identical to

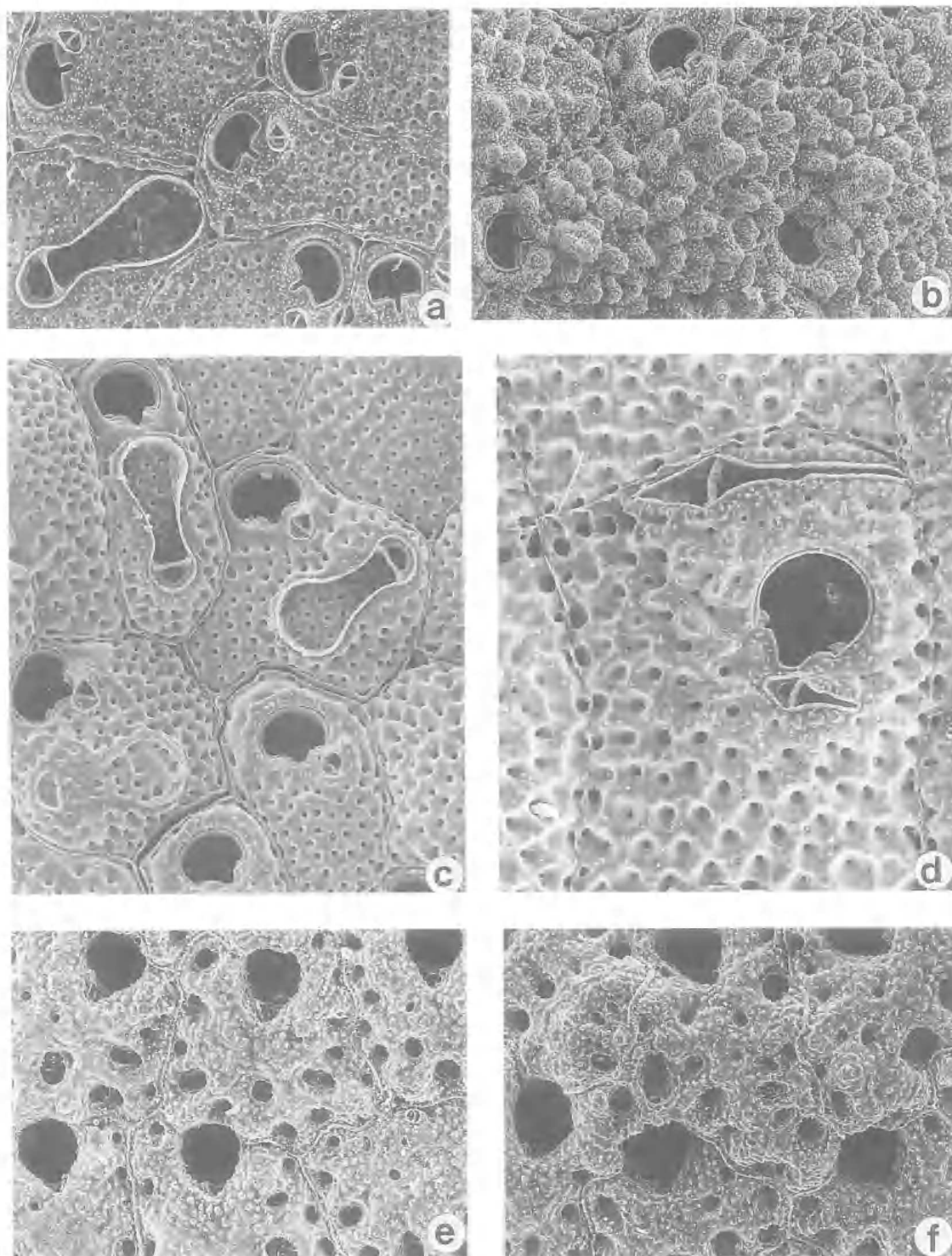


FIG. 20. a,b, *Stylopoma duboisii*; a, $\times 80$; b, $\times 70$. c, *Stylopoma thornelyae*, $\times 80$. d, *Stylopoma viride*, $\times 80$. e,f, *Cigclisula areolata*; e, autozooids, $\times 50$; f, two ovicelled zooids, $\times 50$.

disto-lateral adventitious avicularia; rare. Ovicell globose, as large as an autozoid, with identical calcification and perforation, and with an independent, frontally situated aperture.

REMARKS

The massive, multilaminar colonies of *S. viride* have a characteristic green coloration, muted in living colonies by a thick, greyish-brown frontal cuticle. The pigment is contained within the calcification and persists after the death of the colony.

DISTRIBUTION

This species is known from the Red Sea, Sri Lanka and other localities in the Indian Ocean; it has been widely reported from Malaysia, Indonesia, New Guinea and the Philippines, and is distributed on north and northeast coasts of Australia, and along the Great Barrier Reef.

Family STOMACHETOSELLIDAE Canu & Bassler, 1917

Colony encrusting, forming a thick, multilaminar sheet; or erect, as folded, bilaminar plates attached by an encrusting base. Autozooids thickly calcified; frontal wall with marginal and frontal pores. Primary orifice sinuate or bell-shaped, encircled by a deep, thick peristome. Avicularia adventitious and/or vicarious; or absent. Ovicells present, typically with few, large, frontal lacunae.

Cigclisula Canu & Bassler, 1927

Colony encrusting or erect, unilaminar or multilaminar, often nodular or massive. Frontal wall of autozoid with marginal perforations (sometimes in double or triple series), with stout interareolar ridges developing in later ontogeny; central area of frontal wall imperforate. Primary orifice more or less bell-shaped, the proximal border shallowly concave between distinct condyles. No oral spines. A thickened peristomial rim developing in later ontogeny, characteristically incorporating a proximal suboral avicularium, eccentrically placed and laterally directed. Additional small, adventitious avicularia may be present elsewhere on autozoid; in some species large, vicarious avicularia also occur. Ovicell characteristic: prominent, grossly inflated, sutured, with a few, large, frontal lacunae.

Type species: *Escharoides occlusa* Busk, 1884.

Cigclisula areolata (Kirkpatrick) (Fig. 20c,f)

Lepralia occlusa var. *areolata* Kirkpatrick, 1890a: 618, pl. 16, figs 7, 7a.

Porella areolata: Livingstone, 1926: 91, pl. 8, fig. 4.

Cigclisula areolata: Hastings, 1932: 434.

DESCRIPTION

Colony forming thick, extensive multilaminar sheets. Autozooids oval to hexagonal, strongly convex, thickly calcified, separated by distinct sutures; commonly $0.6-0.7 \times 0.4-0.5$ mm. Primary orifice as wide as long, bell-shaped, with concave proximal border; condyles small, rounded. Frontal calcification coarsely granular, becoming distinctly nodular in later ontogeny, with a double or triple series of marginal pores, but the central area of the frontal wall imperforate. As the frontal wall thickens, stout ridges develop peripherally, eventually forming a series of large, deep areolae, each of which may enclose two or more of the original pores. Orifice encircled by a thick, peristomial rim; a single, small avicularium proximo-medially; its rostrum perpendicular to frontal plane and facing laterally, immersed in peristomial calcification, but with tip of rostrum hooked and distinct. Large vicarious avicularia occur sporadically. Ovicell wider than long, almost as large as autozoid, globular and prominent, with the aperture overhanging the autozoid orifice; bordered by large areolae, and with four to eight large lacunae frontally.

DISTRIBUTION

This species is known only from Torres Strait and the Great Barrier Reef. At Heron Island large colonies were present in two samples from reef crest locations.

Family SMITTINIDAE Levinsen, 1909

Colony encrusting or erect. Autozooids with cryptocystidean frontal wall, evenly perforated or with marginal perforations only. Primary orifice with or without a median proximal denticle (lyrula) and proximo-lateral condyles; oral spines present or absent. Avicularia adventitious, or absent. Ovicell prominent, perforate or imperforate.

Smittoidea Osburn, 1952

Frontal wall of autozooids with marginal pores only. Avicularium situated medially on the frontal wall, immediately proximal to the orifice,

often partly enveloped by the peristome; typically proximally directed. Ovicell prominent, evenly perforated. Vertical walls with mural septula.

Type species: *Smittoidea prolifica* Osburn, 1952.

***Smittoidea pacifica* Soule & Soule**
(Fig. 24e,f)

Smittoidea pacifica Soule & Soule, 1973: 380, figs I, F-H.

DESCRIPTION

Colony a small, silvery-white, unilaminar patch. Autozooids oval to hexagonal, flat or slightly convex, separated by indistinct sutures; $0.4-0.5 \times 0.2-0.3$ mm. Primary orifice wider than long; lyrula anvil-shaped, broad and deep, occupying entire width of orifice; condyles short and blunt, indistinct. No oral spines. Peristome completely encircling orifice, its edge thickened and slightly lobed in later ontogeny; with a conspicuous U-shaped notch medio-proximally, the inner edges of which may be thickened to define a descending groove. Frontal wall coarsely nodular, bordered by large and conspicuous marginal pores. A single suboral avicularium on each autozooid, directed proximally or proximo-laterally; rostrum elongate, finely tapered, rounded at tip, its edges sometimes finely denticulate; crossbar thickened, the proximal opesia circular. Ovicell slightly wider than long, frontal surface with numerous small pores; developing a coarsely nodular ooecial cover, which extends to the distal edge of the peristome, leaving only the central frontal area of the ovicell exposed.

REMARKS

Soule & Soule (1973) founded this species on specimens collected from Hawaii. They included Osburn's (1952) record of *S. reticulata* (J. Macgillivray) from the Galapagos Islands in the synonymy of *S. pacifica*, while noting that one zooid in Osburn's specimen bore six oral spines. The Heron Island specimens here described have been compared with Hawaiian paratype material of *S. pacifica*, which they match exactly.

S. reticulata is distributed in the eastern Atlantic region from the Mediterranean to the Barents Sea, and almost certainly does not occur in the Pacific. Osburn's Galapagos material does not belong to *S. reticulata*, and is possibly not *S. pacifica* either.

***Parasmittina* Osburn, 1952**

Colony encrusting, unilaminar or multilaminar. Frontal wall of autozooid with marginal pores only. Primary orifice with medio-proximal lyrula and paired lateral condyles; oral spines usually present; typically with a well developed peristome. Avicularia adventitious and interzooidal, frequently polymorphic, often numerous; characteristically, one or more occur lateral to the orifice. Ovicell hyperstomial, prominent, with frontal pores; not closed by autozooid operculum. Small basal pore chambers present.

Type species: *Lepralia jeffreysi* Norman, 1876.

Species of *Parasmittina* are common, and often abundant, in shallow reef habitats. Species diversity is usually high (e.g., Soule & Soule, 1973; Hayward, 1988) and it is probable that many tropical species remain to be recognized.

***Parasmittina hastingsae* Soule & Soule**
(Fig. 21a-c)

Parasmittina hastingsae Soule & Soule, 1973: 417, figs 9C,D.

Parasmittina hastingsae: Winston & Heimberg, 1986: 26, figs 59-63.

DESCRIPTION

Colony forming broad, yellowish, multilaminar sheets. Autozooids oval, hexagonal or irregular, convex, separated by distinct sutures; commonly $0.35-0.5 \times c.0.25$ mm. Primary orifice slightly wider than long, rounded; lyrula occupying about half proximal orifice width, with convex edge and bluntly pointed corners; condyles acute, distinct. Two or three (rarely four) short, distal oral spines present in early ontogeny; peristome developed as paired lateral folds, with a deep, medio-proximal sinus between; erect and slightly flared, enclosing distal border of orifice in later ontogeny. Frontal wall of autozooid finely nodular, with a single series of round marginal pores. As calcification thickens in later ontogeny, the boundaries between individual autozooids become increasingly obscure, and the marginal pores much more irregular in outline. Avicularia of three main types, all becoming more frequent in later ontogeny: most characteristically a short, oval type, proximo-lateral to orifice, proximally directed; less frequently, a larger type with rostrum elongate, tapered, rounded distally and serrated along its edge, directed proximally; finally, a large interzooidal type with rostrum tapered, rounded and slightly flared distally, its

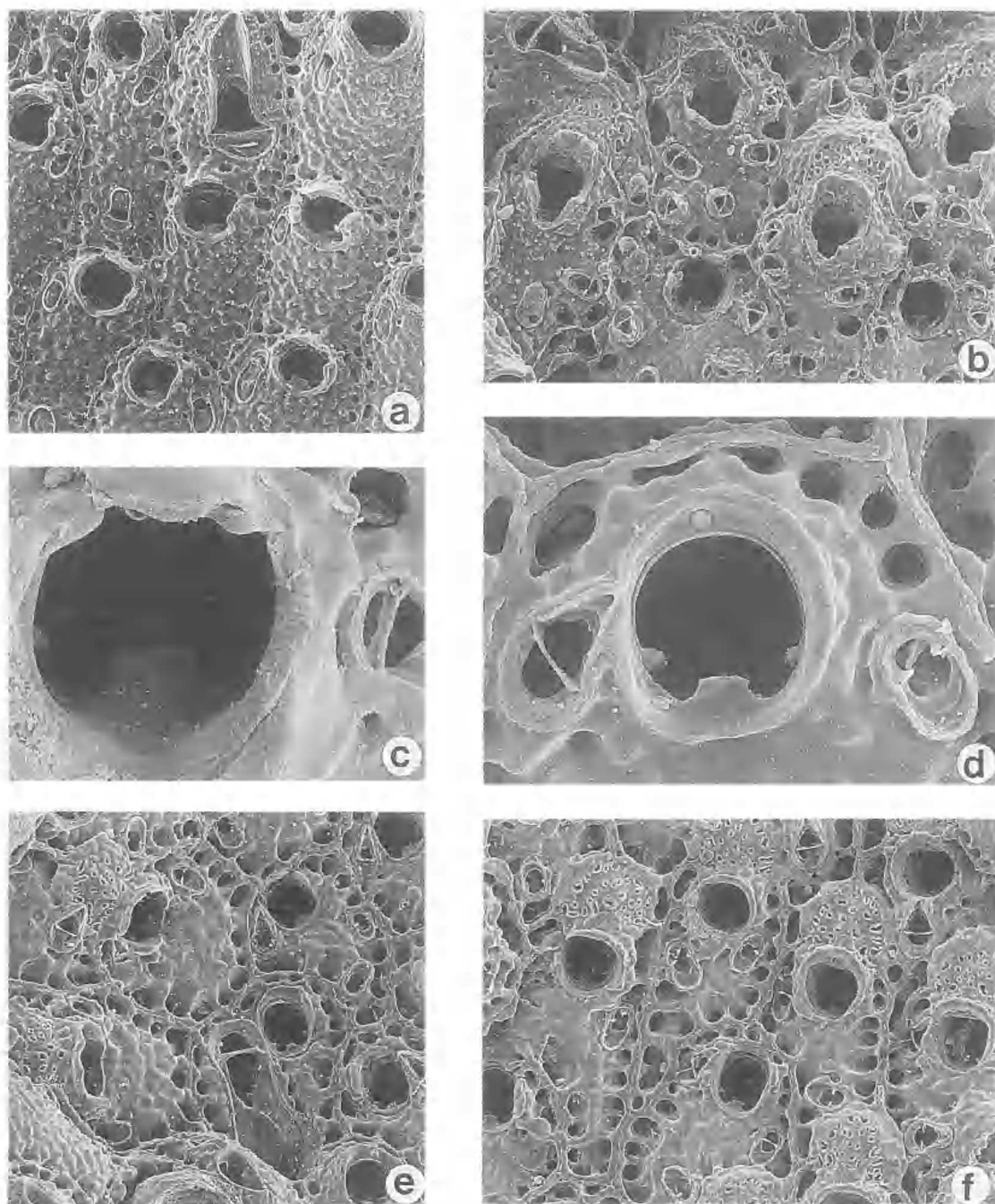


FIG. 21. a-c, *Parasmittina hastingsae*; a, autozooids and a giant avicularium, $\times 60$; b, part of the Hawaiian paratype material, $\times 55$; c, primary orifice, $\times 250$. d-f, *Parasmittina galerita*; d, primary orifice, $\times 220$; e, autozooids and a giant avicularium, $\times 60$; f, ovicelled autozooids, $\times 55$.

edge serrated, distally directed. Ovicell more or less spherical, with 20-30 thickly rimmed, relatively large, frontal pores; the peristome extend-

ing onto its frontal surface, forming a complete tube, distal portion of which becoming immersed below an encroaching ooecial cover.

REMARKS

This species was especially abundant in the Heron Island collections. It is distinguished from other species of the genus by the combination of small, oval avicularia (proximally directed when lateral to orifice), and large avicularia with tapered, serrated rostra, which are proximally directed when lateral to the autozoid orifice, but distally directed when interzoidal. *P. hastingssae* was described from Hawaii by Soule & Soule (1973) and subsequently reported from Komodo, Indonesia, by Winston & Heimberg (1986).

Parasmittina galerita sp. nov.

(Fig. 21d-f)

Smittina parsevalii: Harmer, 1957: 941 [part], pl. 65, fig. 5 [only].

TYPE MATERIAL

HOLOTYPE: GHS231, Heron Island, Sta 16, 13 Apr 1972.

ETYMOLOGY

Latin *galerum*, a helmet.

DESCRIPTION

Colony a multilaminar sheet. Autozooids small, rectangular to irregularly polygonal, convex, separated by thickened sutures. Primary orifice about as wide as long; lyrula short, occupying about half total width of orifice; its edge slightly curved; condyles small, rounded, downcurved, with finely denticulate edges; a single, inconspicuous, mid-distal oral spine present in early ontogeny. Peristome widely open proximally, at first consisting simply of paired, subtriangular lateral lappets, extending to enclose the distal border of the orifice in later ontogeny. Frontal wall coarsely nodular, bordered by large, and conspicuous marginal pores. Avicularia frequent, polymorphic: each autozoid typically with two, lateral suboral avicularia, the first short, 0.1 mm long, oval or shoe-shaped, proximally directed, the second longer, 0.15 mm, with acute triangular rostrum directed disto-medially onto the peristome rim; giant avicularia sporadic, as long as autozooids, the rostrum narrow, spatulate distally, with smooth rim. Ovicell relatively small, wider than long, with about 20 small pores frontally; developing a nodular, peripheral oocial cover, and a distinct frontal lip where the peristome traverses it.

Measurements (means and standard deviations of 20 values, mm): autozoid length 0.51 ± 0.06 ;

width 0.33 ± 0.04 ; orifice length 0.10 ± 0.007 ; width 0.10 ± 0.005 .

REMARKS

The specimens assigned to *Cellepora parsevalii* Audouin by Harmer (1957) encompass at least two species. The Red Sea specimen listed by him (Ghardaqa, 4D) is quite distinct from that from Makassar Strait (38I, Siboga Sta 77), which is the same species as that described here from Heron Island. *P. parsevaliformis* Soule & Soule also has just a single mid-distal oral spine, and a similar array of avicularia, with a short oval type proximally directed, and an acute triangular type directed disto-medially onto the peristome. However, *P. parsevaliformis* differs from *P. galerita* in its longer orifice, narrower sinus, with distinctly cusped corners, and in its ovicell, which is smooth frontally, with a peripheral band of relatively large pores.

Parasmittina latiavicularia (Kirkpatrick)

(Fig. 22a-c)

Smittina latiavicularia Kirkpatrick, 1888: 80, pl. 10, fig. 3.

Parasmittina latiavicularia: Hayward, 1988: 301, fig. 5a.

Parasmittina levivicularia Soule & Soule, 1973: 409, figs 7E-G.

DESCRIPTION

Colony a small, irregular, multilaminar patch. Autozooids oval to hexagonal, convex, separated by distinct sutures; $0.45\text{--}0.7 \times 0.35\text{--}0.45$ mm. Primary orifice longer than wide, distinctly oval, the distal border with a few indistinct denticulations medially; lyrula occupying about half width of proximal edge, slender, with curved edges and cusped corners; condyles oval, prominent, downcurved, with finely denticulate edges. One or two slender, distinct oral spines present in early ontogeny. Peristome consisting almost entirely of paired lateral lappets; widely open proximally. Frontal wall nodular, bordered by a single or double series of large pores. Avicularia numerous: characteristically, single or paired lateral oral, with acute triangular rostrum disto-medially directed, ascending the peristomial lappet; either or both replaced by a short, oval or shoe-shaped avicularium, with proximally directed rostrum; in some autozooids the triangular avicularium may be medio-proximally situated, with the rostrum distally directed, along the edge of the peristome; in older parts of the

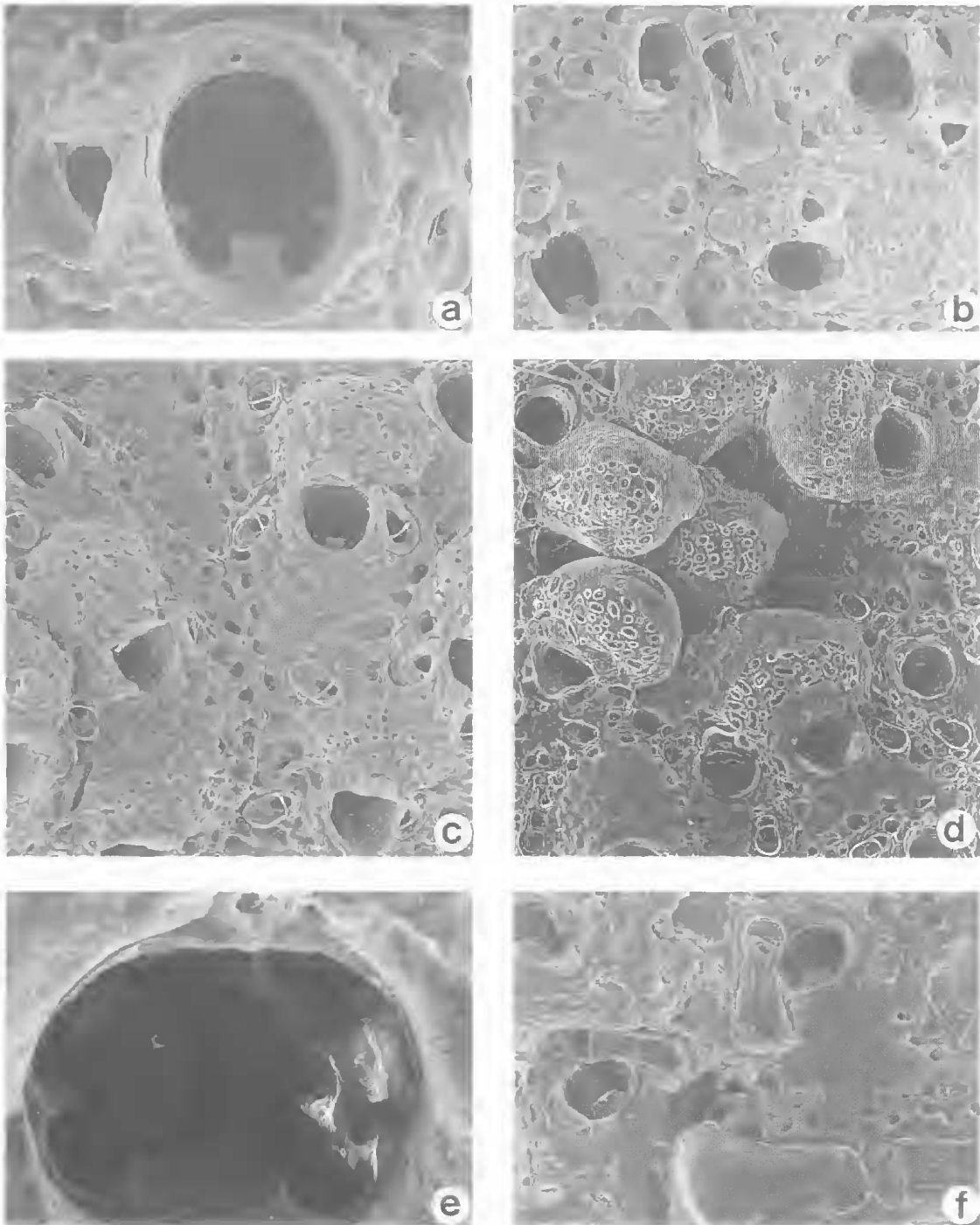


FIG. 22. a-c, *Parasmittina latiavicularia*; a, primary orifice, $\times 240$; b, autozooids and a giant avicularium, $\times 90$; c, ovicelled autozooids, $\times 80$. d-f, *Parasmittina onychorrhyncha*; d, ovicelled autozooids, $\times 60$; e, primary orifice, $\times 400$; f, autozooids and giant avicularia, $\times 90$.

colony the small oval avicularia may proliferate along the margins of the autozooids. Giant avicularia rare, occasionally replacing the lateral suboral avicularium, rostrum shorter than autozoid, broadened or rather angular distally, with an irregularly cusped rim. Ovicell spherical, prominent, with about 20 small frontal pores; becoming coarsely nodular, developing a distinct frontal lip above the secondary orifice, and often with a well developed umbo.

DISTRIBUTION

This rather inconspicuous species has been previously reported only from Mauritius and Hawaii. It was present in two of the Heron Island samples.

Parasmittina onychorrhyncha sp. nov. (Fig. 22d-f)

TYPE MATERIAL

HOLOTYPE: GH5232, Heron Island, Stn 25, 18 Apr 1972.

ETYMOLOGY

Greek *Onychos*, a claw, and *rhynchos*, a snout.

DESCRIPTION

Colony an irregular, multilaminar sheet. Autozooids rectangular, hexagonal or oval at growing edges, but often irregularly polygonal in frontally budded laminae; convex, separated by distinct sutures. Primary orifice wider than long; lyrula short and broad, with straight edge, occupying about half proximal border; condyles thin, pointed, downcurved; typically with a single, slender, mid-distal oral spine. Peristome widely open proximally, consisting largely of paired, subtriangular lateral lappets. Frontal wall distinctly nodular, bordered by conspicuous marginal pores. Avicularia sporadic, frequent on some parts of colony, rare elsewhere, polymorphic: most often short, shoe-shaped, about 0.1mm long, proximo-lateral to orifice and proximally directed; less often, about 0.2mm long, distal or disto-lateral to orifice, narrowly spatulate or bluntly triangular, directed proximo-laterally; occasionally gigantic, occupying half frontal area of autozoid, the rostrum broadly spatulate, deeply cupped, with a coarsely toothed distal rim. Ovicell globose, prominent, closely perforated frontally by numerous small, irregular pores; developing a granular ooecial cover, often slightly raised and frilled where it borders the perforate frontal region of the ovicell.

Measurements (means and standard deviations

of 20 values, mm): autozoid length 0.59 ± 0.05 ; width 0.33 ± 0.05 ; orifice length 0.10 ± 0.007 ; width 0.12 ± 0.006 .

REMARKS

P. delicatula (Busk, 1884), described from Hawaii, and *P. fistulata* (Harmer, 1957), from Indonesia, are very similar species which can be separated principally by the morphology of the primary orifice and the occurrence of particular types of avicularia. These features also serve to distinguish both species from *P. onychorrhyncha*.

Parasmittina serrula Soule & Soule (Fig. 23e,f, 24a)

Parasmittina serrula Soule & Soule, 1973: 386, figs 3D-F.

Parasmittina serrula: Gordon, 1984: 96, pl. 35, figs B, C.

DESCRIPTION

Colony forming small, glistening white patches, rarely more than 5mm in diameter. Autozooids oval to hexagonal, small, convex, separated by deep grooves; $0.3-0.5 \times c.0.25$ mm. Primary orifice wider than long, with denticulate distal border; lyrula occupying about half width of proximal border, with slightly curved edge and cusped corners; condyles downcurved, rounded, with very finely denticulate edges. Two to four long, stout distal oral spines; obliterated in brooding autozooids but persisting into late ontogeny in others. Peristome most prominent laterally and proximally, with a well-marked medio-proximal notch, often flanked on each side by a stout, erect process. Frontal wall finely nodular, bordered by large and distinct marginal pores. Lateral suboral avicularia typically paired, equally-sized; the rostrum slender, parallel-sided, rounded at tip, with very fine serrations along its distal edges; characteristically inclined so that the rostrum lies on its side. Giant avicularia occasional, as long as autozoid, with the rostrum slightly flared distally and very coarsely serrated. Ovicell spherical, smooth, with 15-20 regularly dispersed pores; peristome encroaches onto frontal surface of ovicell in later ontogeny, but an ooecial cover does not seem to develop.

DISTRIBUTION

Soule & Soule (1973) found this to be the commonest species of *Parasmittina* on Hawaiian reefs. It was subsequently described and figured

from the Kermadec Islands by Gordon (1984) and from Belize by Winston (1984). It occurred in three of the Heron Island samples but has not previously been reported from Australia.

Parasmittina turbula sp. nov.
(Fig. 23a-d)

TYPE MATERIAL

HOLOTYPE: GH5233, Heron Island, Stn 25, 18 Apr 1972.

ETYMOLOGY

Latin *turba*, disorder.

DESCRIPTION

Colony encrusting, multilaminar, developing an irregular, mamillate form, the later generations of autozooids lacking regular orientation. Autozooids oval to irregular, convex, separated by distinct sutures; frontal wall irregularly nodular, bordered by large marginal pores, with thickened struts between; 0.5×0.3 mm. Primary orifice about as wide as long (0.12 mm); lyrula occupying about one-third of proximal width, short, rectangular, with a gently curved edge; condyles oval, downcurved, with finely crenulate edges. A single disto-medial spine present; peristome complete, initially with a delicately flared lip, a deep distal embayment accommodating the spine, and a shallow mid-proximal notch flanked by thickened internal ridges. With ontogenetic thickening the peristome becomes deeper, the distal spine is obliterated and the proximal notch accentuated. Avicularia polymorphic, numerous; one or two lateral to the peristome in newly budded autozooids, usually narrow, parallel-sided, from 0.2–0.3 mm long, proximally directed, occasionally shorter, triangular and disto-medially directed; additional avicularia develop in later ontogeny, typically clustered around the peristome, and directed towards the orifice; gigantic avicularia present in a few autozooids, laterally situated and proximally directed, with flared, slightly spatulate mandible. Ovicell spherical, with numerous fine perforations, rapidly enveloped by secondary calcification; with a number of small avicularia developing on its frontal surface, directed towards the autozooidal orifice.

REMARKS

The slender, parallel-sided avicularia recall those of *P. areolata* Soule & Soule. *P. turbula* is distinguished from that species by its single, distal oral spine, the morphology of the lyrula and

condyles, and by the clusters of medially directed avicularia developed around the peristome in later ontogeny.

Pleurocodonellina Soule & Soule, 1973

Colony encrusting. Autozoid frontal wall with marginal pores only. Primary orifice with strongly developed condyles; proximal border concave, developed as a broad or shallow sinus. Peristome developing in early ontogeny, completely surrounding orifice, its inner edge often thickened medio-proximally and forming a secondary sinus. Distal oral spines present. Avicularia adventitious, dimorphic, typically situated proximo-lateral to orifice. Ovicell with small, scattered pores. Vertical walls with small uniporous septula.

Type species: *Pleurocodonellina lahainae* Soule & Soule, 1973.

Pleurocodonellina signata (Waters)
(Fig. 24b)

Smittia signata Waters, 1889: 17, pl. 3, figs 4–6.

Smittina signata: Harmer, 1957: 928, pl. 63, figs 27–29.

Parasmittina signata: Winston & Heimberg, 1986: 21, figs 51–54.

DESCRIPTION

Colony forming extensive, pinkish brown, unilaminar sheets. Autozooids commonly 0.5×0.3 mm, with a finely nodular frontal wall, bordered by a single series of large and conspicuous areolae. Primary orifice wider than long, with broad, flat condyles delimiting a narrow, rounded, proximal sinus; one to three distal oral spines present in early ontogeny. Peristome thin, erect, completely surrounding orifice and obliterating spine bases. Most autozooids with a single avicularium proximo-lateral to orifice; rostrum slender, elongate triangular, proximally directed. Ovicell recumbent on succeeding autozoid, wider than long; frontal surface slightly flattened, with small distal pores.

REMARKS

Cheetham & Sandberg (1964) tentatively assigned this species to *Rimulostoma* Vigneaux, while noting that the published accounts of both the genus (Vigneaux, 1949) and its Miocene type species (Duvergier, 1921) were inadequate for detailed morphological comparisons. Soule & Soule (1973) suggested that *Smittia signata* Waters might be placed in their genus

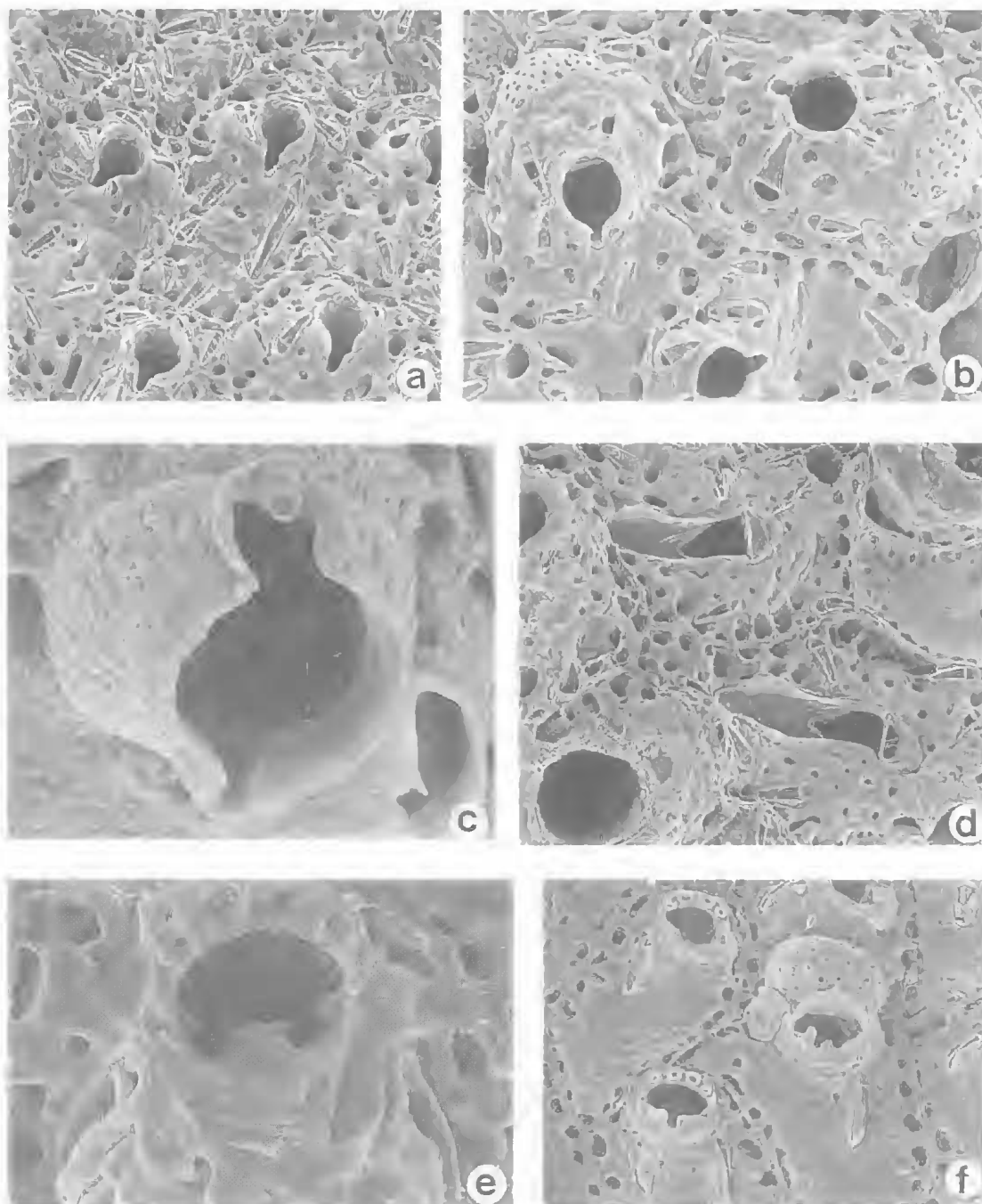
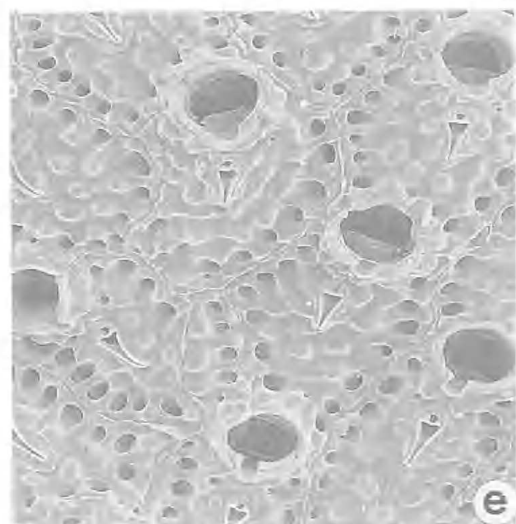
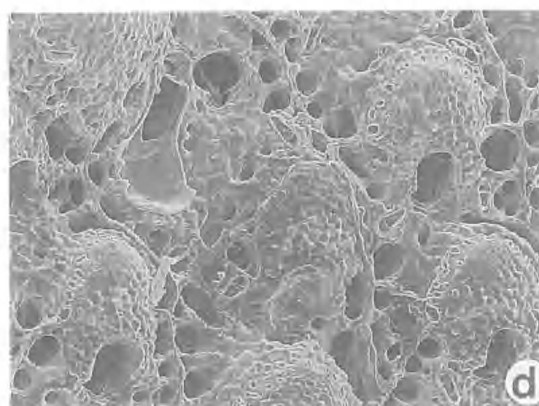
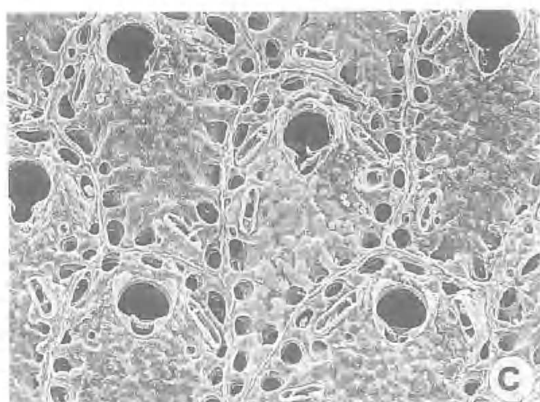
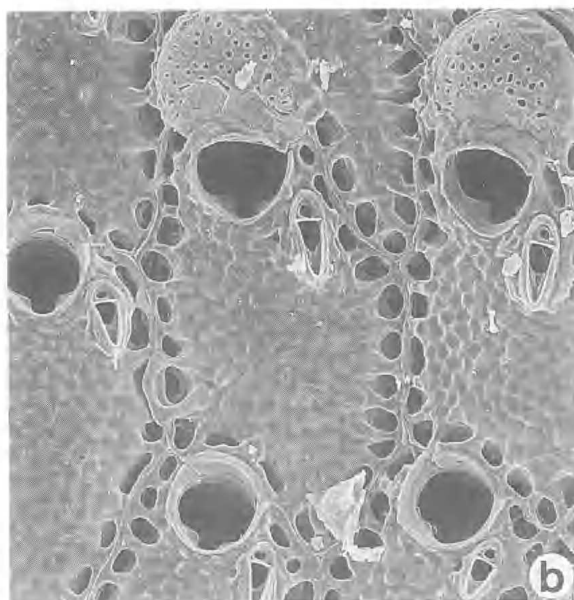
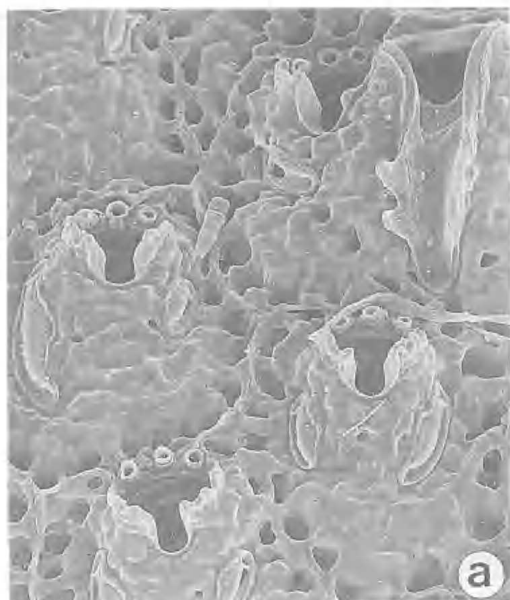


FIG. 23. a-d, *Parasmittina turbula*; a, $\times 70$; b, $\times 95$; c, primary orifice, $\times 340$; d, giant avicularia, $\times 60$. e, f, *Parasmittina serrula*; e, primary orifice, $\times 350$; f, $\times 80$.

FIG. 24. a, *Parasmittina serrula*, $\times 130$. b, *Pleurocodonellina signata*, $\times 90$. c, d, *Pleurocodonellina clavicula*; c, $\times 60$; d, $\times 60$. e, f, *Smittoidea pacifica*; e, $\times 80$; f, $\times 155$.



Pleurocodonellina, and that suggestion is followed here. In all morphological characters *S. signata* conforms to the diagnosis of *Pleurocodonellina*. In particular, the flaring peristomial rim which obliterates the distal spines present in early ontogeny is closely similar to that of the type species, and only a more pronounced development of the paired lateral condyles is necessary to produce the narrow, rounded sinus seen in *P. signata*.

DISTRIBUTION

This species is practically circumtropical in distribution. It ranges throughout the Indo-West-Pacific realm, and has been reported from Mauritius, East Africa, West Africa, and the Caribbean. It is quite common in shallow reef habitats, and at Heron Island occurred in five of the samples studied.

Pleurocodonellina clavícula sp. nov. (Fig. 24c,d)

TYPE MATERIAL

HOLOTYPE: GH5234, Heron Island, Sta 12, 12 Apr 1972.

ETYMOLOGY

Latin *clavícula*, diminutive of *clavis*, a key.

DESCRIPTION

Colony a broad, encrusting, multilaminar sheet. Autozooids rectangular, hexagonal or irregularly polygonal, rather flat, separated by distinct, thickened sutures. Frontal wall thickly calcified, coarsely nodular, bordered by a single series of large marginal pores. Primary orifice longer than wide, the proximal third comprising a deep, broad, U-shaped sinus, delimited by flat, rounded triangular condyles; encircled by a thin, low, peristomial rim. No oral spines. Avicularia present lateral to orifice in newly budded autozooids, later developed elsewhere along margins of autozooids; slender, parallel-sided, rounded distally and proximally; not infrequently a giant avicularium present, extending down whole length of autozoid, the rostrum 0.4mm long, broadly spoon-shaped, deeply cupped distally, with a coarsely denticulate rim. Ovicell prominent, globular, wider than long, with a crescentic series of irregular pores, developing a coarsely nodular ooecial cover.

Measurements (means and standard deviations of 20 values, mm): autozoid length 0.55 ± 0.05 ;

width 0.37 ± 0.04 ; orifice length 0.11 ± 0.008 ; width 0.10 ± 0.01 .

REMARKS

The sinuate orifice, encircling peristomial rim, lateral suboral avicularia and perforate ovicell all indicate that this undescribed species is appropriately placed in *Pleurocodonellina*. A single large colony was present in sample 12, from the reef flat west of the cay.

Family PETRALJELLIDAE Harmer, 1957

Colony encrusting; or forming erect, laminate plates. Autozooids with perforated frontal wall. Primary orifice with or without oral spines and condyles. Avicularia adventitious, often associated with orifice. Ovicell with small frontal pores. Vertical and basal walls with multiporous septula.

Sinupetraliella Stach, 1936

Colony encrusting, or erect and bilaminar. Autozooids with regularly perforate, cryptocystidean frontal wall. Primary orifice with asymmetrically developed condyles, defining a small sinus; bordered proximally by a low peristome incorporating a small avicularium. No oral spines. Frontal adventitious avicularia present. Ovicell with entoecium finely perforated, ectoecium largely membranous, developing patches or basal struts of calcification in later ontogeny. Vertical walls with multiporous septula.

Type species: *Petralia litoralis* Livingstone in Hastings, 1932.

Sinupetraliella litoralis (Livingstone in Hastings) (Fig. 25a)

Petralia litoralis Livingstone MS, Hastings, 1932: 438, pl. 1, fig. A, text-fig. 15.

Sinupetraliella litoralis: Harmer, 1957: 706, pl. 45, figs 11-13.

DESCRIPTION

Colony developing broad, loosely encrusting, unilaminar sheets; deep brown in colour. Autozooids rectangular to hexagonal, convex, separated by thin sutures; $0.8-0.9 \times 0.4-0.6$ mm. Frontal wall thickly calcified, densely perforated by large, round pores. Primary orifice about as wide as long, with a pair of pointed condyles, asymmetrically developed, delimiting an oval,

proximal sinus. Peristome a low rim around proximal and lateral border of orifice, incorporating a small avicularium, 0.1 mm long, transversely orientated, its plane perpendicular to orifice, situated immediately above the sinus; in later ontogeny the avicularium partly hidden by a stout mucro developed above it. Frontal adventitious avicularia sparsely developed, usually along margins of autozooids; rostrum slender, elongate oval, variably orientated. Ovicell slightly wider than long, partly overhanging autozoid orifice; entoecium finely perforate, appearing dimpled, ectoecial calcification limited to a narrow, peripheral band and a few radiating struts.

DISTRIBUTION

S. litoralis was described from the Low Isles (Hastings, 1932) and reported by Harmer (1957) from Celebes. Large colonies were present in three of the Heron Island samples.

Family CREPIDACANTHIDAE Levinsen, 1909

Colony encrusting. Frontal wall of autozooids with marginal pores and peripheral spines. Orifice with convex or distinctly rectangular proximal edge, appearing trilobed. Avicularia adventitious, with setiform mandibles. Ovicell hyperstomial, with frontal pores. Vertical walls with small basal pore chambers. Ancestrula tatiform.

Crepidacantha Levinsen, 1909

Colony encrusting, unilaminar. Autozoid frontal wall with marginal pores only; primary orifice contracted laterally, with pronounced lateral condyles, the proximal edge frequently concave, and thus appearing trifoliate; no oral spines. Avicularia adventitious, usually paired, lateral to orifice; mandible setiform. Ovicell hyperstomial, globular, closed by autozoid operculum; with an uncalcified area of ectoecium frontally, bordered by small pores in the entoecium. Small basal pore chambers present, with intervening spinous processes visible in autozooids at the growing margin. Ancestrula tatiform.

Type species: *Flustra poissonii* Audouin, 1826.

Crepidacantha crinispina Levinsen (Fig. 25c)

Crepidacantha poissoni var. *crinispina* Levinsen, 1909: 266, text-figs. 1-3, 5, 6.

Crepidacantha crinispina: Brown, 1954: 248, fig. 1C; Gordon, 1984: 100, pl. 37, fig. B.

DESCRIPTION

Colony forming broad, irregular sheets. Autozooids oval to hexagonal, convex, separated by deep grooves; $0.35\text{--}0.50 \times 0.25\text{--}0.45\text{ mm}$. Frontal wall finely granular, with indistinct marginal pores. Primary orifice longer than wide, with conspicuous lateral processes, appearing distinctly trifoliate. Avicularia paired, situated level with proximal corners of orifice; rostra oval, about 0.05 mm long, directed proximally or proximo-medially. Ovicell about as wide as long, entoecium entirely exposed frontally, with only a peripheral band of ectoecium.

DISTRIBUTION

C. crinispina ranges in the western Pacific from New Zealand to the Philippines, and westwards to Indonesia and Thailand. Gordon (1984) reported it as a common intertidal species around North Island, New Zealand. It has also been reported from the southwest Atlantic (Lopez Gappa, 1977) and from Gough Island and Ascension in the central Atlantic (Hayward, 1980).

Crepidacantha carsioseta Winston & Heimberg (Fig. 25d)

Crepidacantha carsioseta Winston & Heimberg, 1986: 27, figs 64-66.

DESCRIPTION

Autozooids oval to hexagonal, $0.35\text{--}0.45 \times 0.3\text{ mm}$. Frontal wall smooth, bordered by inconspicuous marginal pores. Primary orifice longer than wide, trifoliate, with a broadly rounded proximal lip. Avicularia paired, proximal to orifice, directed medially; mandible setiform. Ovicell spherical, smooth, with a curved band of pores crossing the frontal surface distally.

DISTRIBUTION

This species has recently been described (Winston & Heimberg, 1986) from two localities in Indonesia and is here reported from Australia for the first time. The material from Heron Island consists of small colonies from sample 25.

Family INVERSIULIDAE Vigneaux, 1949

Colony encrusting. Autozooids with tuberculate frontal wall evenly perforated by small pores;

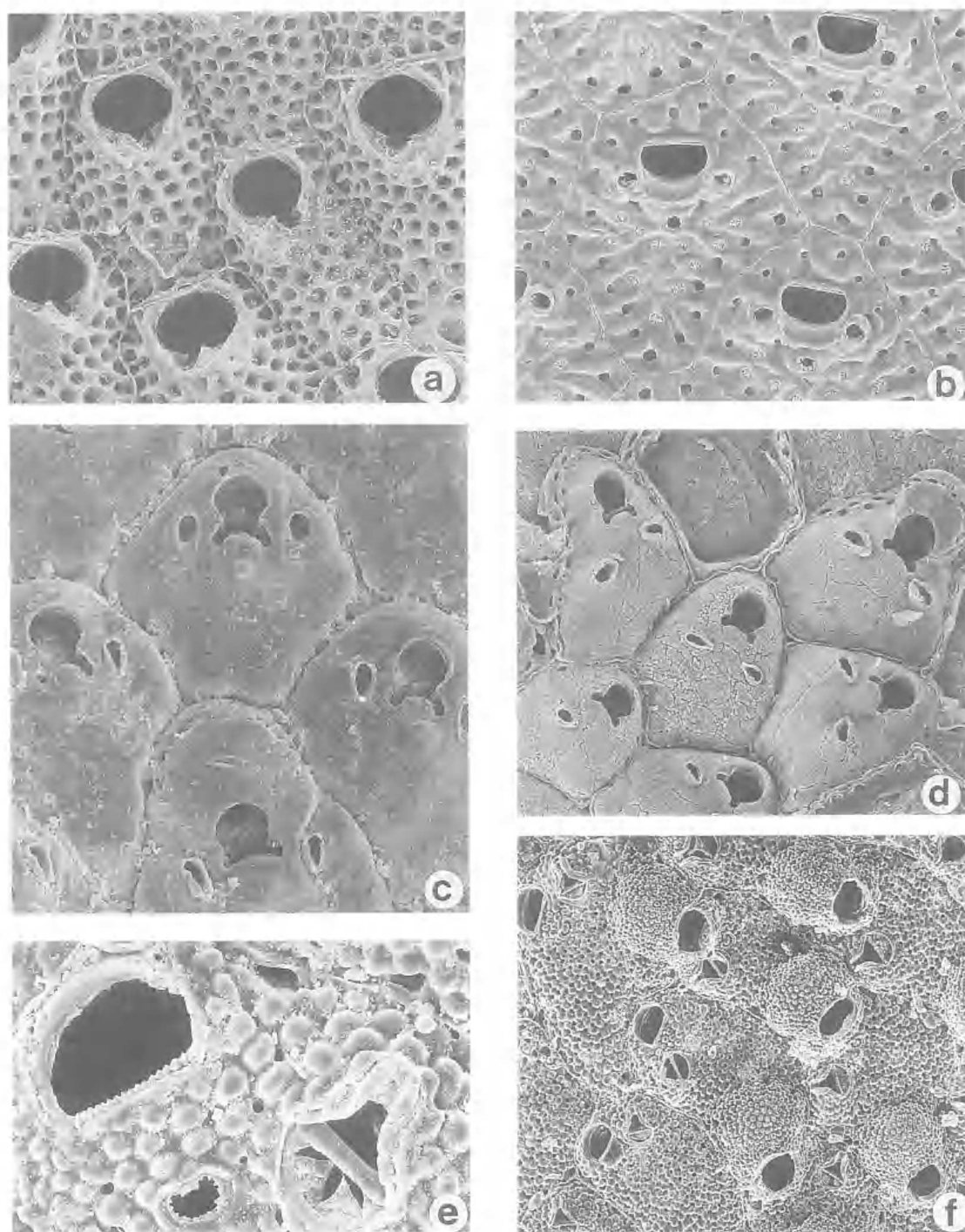


FIG. 25. a, *Sinupetraliella litoralis*, $\times 40$. b, *Inversiula inversa*, $\times 70$. c, *Crepidacantha crinispina*, $\times 90$. d, *Crepidacantha carsioseta*, $\times 75$. e, f, *Microporella orientalis*; e, $\times 220$; f, $\times 50$.

a prominent suboral ascopore present. Orifice with straight distal rim and concave proximal rim; the operculum hinged along its distal edge; no condyles; no oral spines. Avicularia adventitious. No ovicells.

Inversiula Jullien, 1888

Colony encrusting, unilaminar. Autozooids with tuberculate frontal wall perforated by numerous simple or stellate pores; primary orifice with reversed orientation, the semicircular operculum hinged along its straight distal edge; ascus opening via a well-defined ascopore proximal to the orifice; no oral spines. Avicularia adventitious; typically paired, lateral to orifice. Embryos brooded internally. Small basal pore chambers present.

Type species: *Inversiula nutrix* Jullien, 1888.

***Inversiula inversa* (Waters)
(Fig. 25b)**

Porina? inversa Waters, 1887: 95, pl. 4, fig. 23.

Inversiula inversa: Harmer, 1957: 956, pl. 72, figs 24, 32, 33.

DESCRIPTION

Colony forming small, irregular patches. Autozooids irregularly hexagonal, separated by distinct sutures; $0.55\text{--}0.65 \times c.0.5\text{ mm}$. Frontal wall with raised ridges and tubercles, which form a radiating series around the edges; with distinct marginal pores immersed between thickened ridges, and large, stellate pores over the central part, each on a raised tubercle. Ascopore slightly larger than frontal pores, stellate, also on a thickened tubercle, immediately proximal to orifice. Avicularia proximo-lateral to orifice, paired, shortly columnar; with oval rostrum, 0.06 mm long.

DISTRIBUTION

I. inversa has been reported sporadically along the eastern seaboard of Australia, from New South Wales to Torres Strait, and from the Philippine Islands. It was present in two of the Heron Island samples.

Family MICROPORELLIDAE Hincks, 1877

Colony encrusting; or forming erect, bilaminar plates, attached by an encrusting base; or arborescent, freely branching. Autozoid frontal wall evenly perforated, or with marginal pores only; a

conspicuous ascopore present proximal to orifice. Orifice typically D-shaped, lacking condyles; oral spines present or absent. Avicularia adventitious, or absent. Ovicell hyperstomial. Vertical walls with basal pore chambers or mural septula.

Microporella Hincks, 1877

Colony encrusting. Autozooids with nodular frontal wall perforated by scattered pores; ascopore situated in distal half of autozoid, conspicuous. Primary orifice D-shaped. Distal oral spines present, but sometimes small, and impermanent. Avicularia adventitious, mandible setiform. Ovicell prominent, imperforate or with few, minute pores; closed by autozoid operculum. Large basal pore chambers present.

Type species: *Eschara ciliata* Pallas, 1766.

***Microporella orientalis* Harmer
(Fig. 25e,f)**

Microporella orientalis Harmer, 1957: 962, pl. 62, figs 25-28, 38.

[not] *Microporella orientalis*: Gordon, 1984: 103, pl. 39, fig. C.

DESCRIPTION

Colony developing broad, unilaminar sheets. Autozooids oval to hexagonal, convex, separated by distinct sutures; $0.5\text{--}0.7 \times 0.35\text{--}0.5\text{ mm}$. Primary orifice wider than long, $0.08 \times 0.12\text{ mm}$, the proximal edge finely denticulate. Three slender, distal oral spines present in early ontogeny, missing in most autozooids distant from growing edge. Frontal wall appearing distinctly nodular, densely perforated by small, round pores. Ascopore separated from proximal edge of orifice by a distance slightly less than one orifice length, with slightly thickened rim and coarsely denticulate, crescentic lumen. A single avicularium on each autozoid, situated lateral to ascopore, with broad, thick crossbar and semicircular proximal opesia; the rostrum abruptly tapered and narrowest distally; mandible heavily sclerotized and appearing dark brown, $0.2\text{--}0.25\text{ mm}$ long, setiform, or variously broadened on one or both sides of the median rachis, and typically with a pair of short, hooked, lateral processes close to the base. Ovicell more or less spherical, nodular, with minute pores scattered over its surface; brooding autozooids develop a thickened peristomial rim, peaked medially, which passes distal to the ascopore and fuses on each side with the ovicell.

REMARKS

Harmer (1957) possibly included more than one species in his account of *M. orientalis*, and his synonymy needs to be carefully re-examined. The Heron Island specimens have been compared with the holotype (Siboga Stn 50, W. Flores), and found to be almost identical to it; the size and shape of the primary orifice are characteristic for the species, as are the three delicate, distal oral spines. The avicularian mandible varies in form throughout a single colony and there is no utility in denoting those specimens with lanceolate mandibles as '*orientalis* var.' (Harmer, 1957:963). It is probable that *M. orientalis* occurs generally throughout the western Pacific, and perhaps extends into the Indian Ocean, but the wider geographical distribution accorded it by Harmer (1957) should not be accepted until all of the specimens and records listed by him have been scrutinized again. The *M. orientalis* described and figured by Gordon (1984) has four to six oral spines, a smooth proximal border to the orifice, an incomplete peristome in brooding autozooids, and a striking, saucer-like rim to the ascopore; it clearly represents a distinctly different species.

Microporella fimbriata sp. nov.
(Fig. 26a-c)

TYPE MATERIAL

HOLOTYPE: GH5235, Heron Island, Stn 25, 18 Apr 1972.

PARATYPE: GH5236, as for holotype.

ETYMOLOGY

Latin *fimbria*, a fringe.

DESCRIPTION

Colony forming an extensive unilaminar sheet. Autozooids oval to hexagonal, broad and rather flat, separated by distinct sutures; $0.5\text{--}0.65 \times 0.5\text{--}0.6\text{ mm}$. Primary orifice wider than long, proximal edge with a slightly curved, coarsely denticulate inner rim, the outer tooth on each side especially prominent. Four slender distal oral spines present in the youngest autozooids, lost in later ontogeny. Frontal wall coarsely nodular, densely perforated by regularly distributed, round pores; ascopore close to orifice, separated from its proximal edge by a distance equivalent only to one-third of orifice length; rim oval, thickened, smooth, lumen shallowly crescentic, with fine denticulations. Each autozooid with a single avicularium lateral to ascopore, without a pronounced rostrum, but with its frontal surface

symmetrical about a pair of stout, median condyles; mandible thin, setiform, up to 0.7 mm long, laterally directed when at rest. Ovicell comparatively small, slightly wider than long, coarsely nodular, with scattered, minute pores; aperture rather angular, with a smooth, thickened border.

REMARKS

This is possibly the species described from Sumbawa, Indonesia by Harmer (1957), who referred it to the North Pacific species *M. vibraculifera* Hincks.

Fenestrulina Jullien, 1888

Colony encrusting, unilaminar. Frontal wall of autozooid with pores in marginal series, or scattered over its entire surface; pores typically stellate or complexly reticulate; ascus opening via a conspicuous ascopore proximal to primary orifice, often denticulate or reticulate. Primary orifice D-shaped, with straight proximal edge; spines present or absent. Avicularia absent. Ovicell with membranous ectooecium, calcified entooecium, and marginal pores. Large basal pore chambers present.

Type species: *Cellepora malusii* Audouin, 1826.

Fenestrulina caseola Hayward
(Fig. 26d)

Fenestrulina caseola Hayward, 1988: 325, pl. 10, fig. d.

DESCRIPTION

Colony forming flat, unilaminar sheets. Autozooids oval to irregularly hexagonal, broad, gently convex; commonly $0.6 \times 0.5\text{ mm}$. Frontal wall densely perforated by large, round, stellate pores; ascopore separated from proximal edge of orifice by a distance equivalent to orifice length, with crescentic, denticulate foramen. No oral spines. Ovicell broader than long, depressed and not very prominent; frontal surface with a thickened transverse ridge; marginal pores small, indistinct.

DISTRIBUTION

A single large colony was present in sample 25. This species was recently described from the Mascarene Islands, Indian Ocean (Hayward, 1988), and the Heron Island record thus marks only its second reported occurrence.

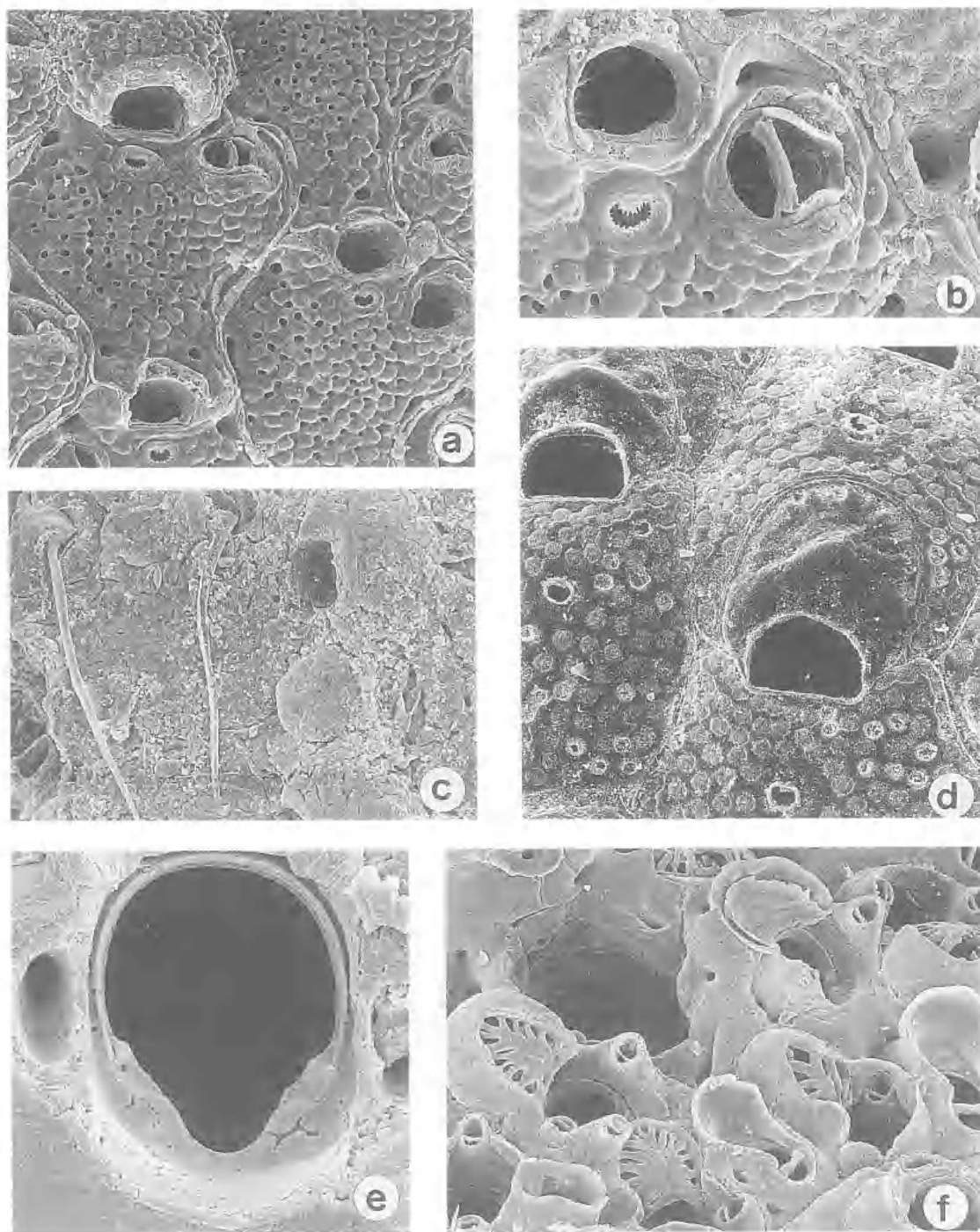


FIG. 26. a-c, *Microporella fimbriata*; a, $\times 80$; b, $\times 170$; c, uncleaned autozooids, to show avicularian mandibles, $\times 80$. d, *Fenestulina caseola*, $\times 90$. e,f, *Celleporina reginae*; e, primary orifice, $\times 330$; f, $\times 110$.

Family MARGARETTIDAE Harmer, 1957

Colony erect, branching, jointed, attached by cuticular rhizoids. Autozooids with ridged frontal wall, perforated by minute pores, with a median ascopore. Primary orifice rounded, hidden by a projecting, tubular peristome. No spines. No avicularia. Ovicell submerged in peristome, which is conspicuously inflated in brooding autozooids. Ancestrula erect, resembling later autozooids, with a chitinous basal attachment.

Margaretta Gray, 1843

Colony erect, branching, jointed, attached by cuticular rhizoids; consisting of cylindrical, straight or curving, internodes linked by brown cuticular nodes, each arising from a short, calcified basis rami developed by the parent internode. Each node and basis rami consists of single, double or triple tubes. Autozooids ordered in whorls of two to eight around the axis of the internode; frontal wall granular, densely perforated and appearing reticulate; a disto-medial ascopore present. Primary orifice orbicular, visible only in earliest ontogeny, obscured by a long, cylindrical peristome, typically perforated and longitudinally ridged. No spines. No avicularia. Ovicell peristomial, hidden; brooding autozooids with dimorphic peristomes, typically longer, curved, or with a modified secondary orifice.

Type species: *Cellaria cereoides* Ellis & Solander, 1786.

Margaretta tenuis Harmer
(Fig. 27a)

Margaretta tenuis Harmer, 1957: 840, pl. 55, figs 13-18.

Margaretta tenuis: Hayward, 1988: 330, pl. 11, fig. a.

DESCRIPTION

Colony generally sparsely branched, internodes 2-3mm long, 0.5mm wide. Autozooids in triple whorls, 0.8-1.0 × c.0.4mm, fusiform, with finely and regularly reticulate frontal shields, the boundaries between adjacent autozooids not distinct. Basis rami tripartite; nodes consisting of short, tripartite tubes. Peristomes of fertile autozooids projecting at right angles to internode axis, but otherwise not markedly different from others.

DISTRIBUTION

M. tenuis has been reported from Queensland, Torres Strait, the Philippine Islands, and from many Indonesian localities; it ranges westwards to Mauritius and the Red Sea.

Margaretta triplex Harmer
(Fig. 27b)

Margaretta triplex Harmer, 1957: 841, pl. 55, figs 8-11

Margaretta triplex: Ryland, 1984: 72, fig. 39.24; Winston & Heimberg, 1986: 30, figs 70-72

DESCRIPTION

Colony stout, richly branched, up to 100mm high; internodes straight or curved up to 30mm long, 1mm wide. Autozooids in whorls of four, 1.2-1.4 × c.0.6mm, elongate oval, the frontal walls finely reticulate, boundaries between autozooids generally distinct. Basis rami and node tripartite. Peristomes of fertile autozooids projecting at right angle to internode axis, short, very broad based and appearing volcano-like in profile.

DISTRIBUTION

M. triplex is known from Queensland, Torres Strait and Indonesia, and has also been reported from Zanzibar.

Superfamily CELLEPOROIDEA Johnston, 1838

Family CELLEPORIDAE Johnston, 1838

Colony encrusting, multilaminar, pisiform, nodular or mamillate; or erect, attached by an encrusting base, irregularly lobed or branched. Autozooids without regular orientation; frontal wall smooth, with marginal pores. Orifice with concave or conspicuously sinuate proximal border; condyles present; spines present or absent. Avicularia adventitious, and/or vicarious or interzooidal; frequently polymorphic. Ovicell present, variously perforated, not closed by autozoid operculum.

Turbicellepora Ryland, 1963

Colony encrusting, multilaminar, often nodular or massive, or erect and branching. Frontal wall of autozoid with marginal pores only. Primary orifice with sinus; oral spines present or absent. Avicularia polymorphic: adventitious, lateral-oral; vicarious, varying in size. Ovicell with scat-

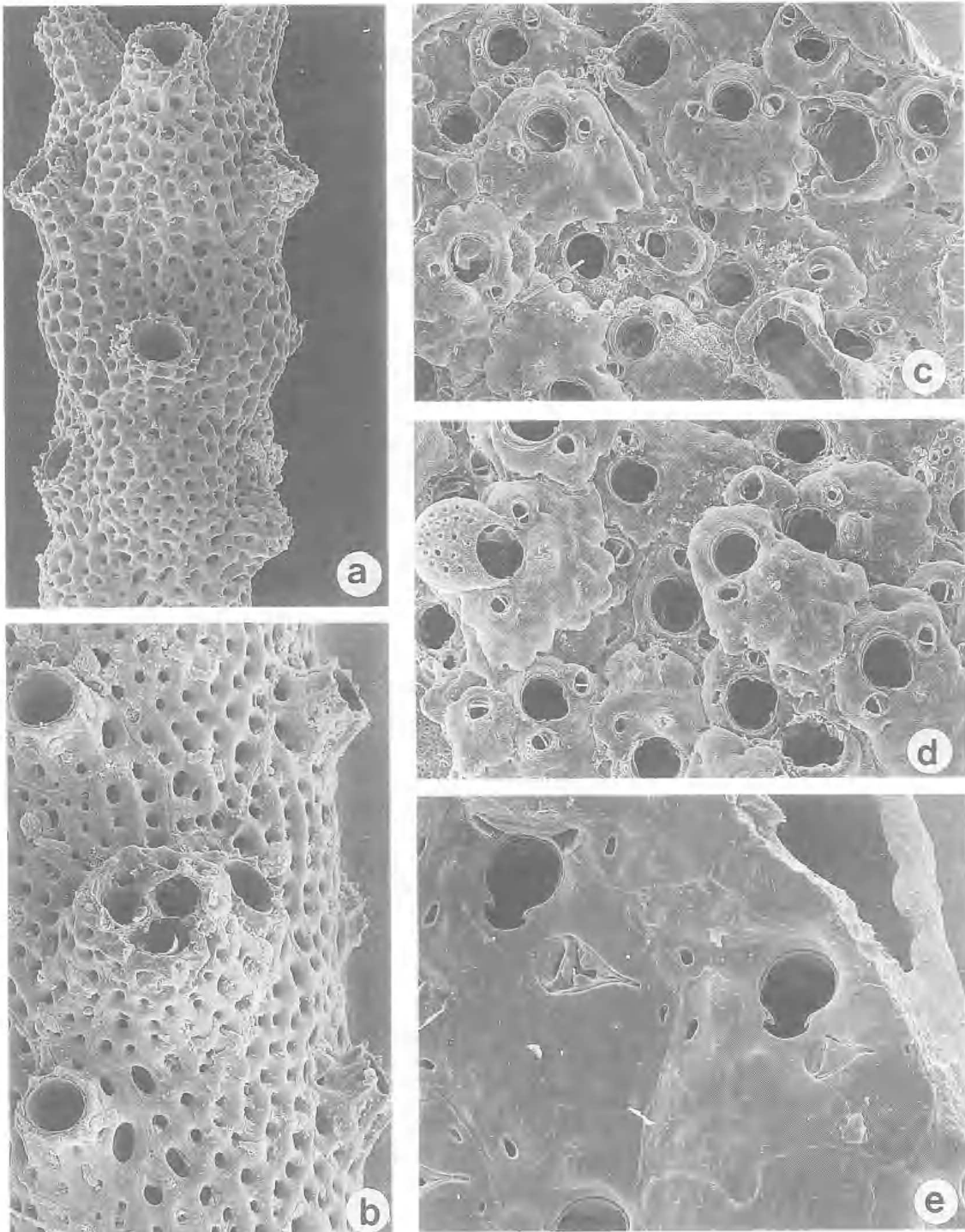


FIG. 27. a, *Margaretta tenuis*, branch tip, $\times 50$. b, *Margaretta triplex*, part of a branch showing a triple branch base, $\times 50$. c,d, *Turbicellepora ampla*; c, $\times 50$; d, $\times 55$. e, *Schedocleidochasma porcellanum*, $\times 90$.

tered frontal pores, not closed by autozoid operculum. Basal pore chambers present.

Type species: *Cellepora coronopus* Wood, 1844.

***Turbicellepora ampla* (Kirkpatrick)**
(Fig. 27c,d)

Schizoporella ampla Kirkpatrick, 1888: 76, pl. 7, fig. 4.

Stephanosella bernardii Hammer, 1957: 1051, pl. 74, figs 21-23.

Turbicellepora ampla: Hayward, 1988: 341, figs 6d,e.

DESCRIPTION

Colony forming multilaminar, nodular encrustations. Autozooids strongly convex, with distinct, lobed, boundaries; the frontal wall smoothly calcified, with indistinct, radiating folds; marginal pores small and inconspicuous. Primary orifice 0.12mm long, with a broad, V-shaped sinus comprising about one-third its length; with a pronounced distal and lateral peristomial rim; no oral spines. Lateral oral avicularia single or paired; rostrum oval, acute to frontal plane, disto-laterally directed. Vicarious avicularia dimorphic: with oval rostrum similar to, but larger than, the lateral oral type, or larger with broadly spatulate rostrum. Ovicell with numerous small, papillate frontal pores.

DISTRIBUTION

This species was originally described from Mauritius (Kirkpatrick, 1888). It is known from a number of localities in the Indo-Malayan region, but its presence in the Red Sea has yet to be substantiated (Hayward, 1988).

***Celleporina* Gray, 1848**

Colony encrusting, pisiform or lenticular, multilaminar. Orifice with a sinus; flanked by paired lateral oral avicularia, with columnar chambers, incorporated into the peristome. Ovicell prominent, spherical, with a perforated area of entoecium, the tabula, frontally; not closed by the zooidal operculum. Small basal pore chambers present.

Type species: *Lepralia hassallii* Johnston, 1847.

***Celleporina reginae* sp. nov.**
(Fig. 26e,f)

TYPE MATERIAL

HOLOTYPE: GH5237, Heron Island, Sta 16, 13 Apr 1972.

ETYMOLOGY

Latin *regina*, queen.

DESCRIPTION

Colony encrusting, mamillate. Autozooids at growing edge convex; $0.4-0.45 \times 0.25-0.35$ mm; frontal wall smooth, with few, relatively large marginal pores. Primary orifice longer than wide, with a broad, U-shaped sinus comprising more than one-third its total length; condyles thickened and rounded; no oral spines. Paired lateral oral avicularia present, with slender, columnar cystids; rostra elliptical, with finely dentate distal edges, acute to plane of orifice and invariably directed laterally. A low, thin peristome encloses the proximal half of the orifice, between the two avicularia, but does not obscure it. Vicarious avicularia frequent, up to 0.25mm long, the rostrum broadly spatulate and deeply cupped distally; crossbar stout, lacking a columella. Ovicell slightly longer than wide; ectoecium thick and smooth, with a thickened ridge bordering the frontal area of entoecium; frontal marginal pores large, elongate and slit-like, so that the entoecium appears to consist of a radiating series of fused struts.

Measurements (means and standard deviations of 20 values, mm): orifice length 0.11 ± 0.007 ; width 0.10 ± 0.007 .

REMARKS

C. reginae is distinguished from other western Pacific species of *Celleporina* by its deeply sinuate orifice, and laterally directed lateral oral avicularia. A single large colony was present in sample 16, from the reef crest northeast of the cay.

Family PHIDOLOPORIDAE Gabb & Horn,
1862

Colony encrusting, unilaminar or multilaminar, often massive; or erect, attached by an encrusting base, forming bilaminar plates, or dichotomously branching arborescent forms, or complex, anastomosed, reticulate structures. Autozoid frontal wall with marginal pores only. Primary orifice with concave or conspicuously sinuate proximal border, the distal border finely denticulate; condyles present; oral spines present or absent. Avicularia adventitious, and/or vicarious or interzooidal. Ovicells present, with uncalcified area of ectoecium frontally; often with a well developed

labellum; median longitudinal fissures characteristic of some genera; not closed by autozooid operculum.

Reteporella Busk, 1884

Colony erect, attached by an encrusting base; branching dichotomously, developing an open arborescent structure, or with the branches anastomosing to form regular reticulate structures; fan-shaped, or cup-shaped, or complexly folded. Autozooids in two to many longitudinal series, on a defined frontal surface; abfrontal surface of colony consisting of blind kenozooids, usually bearing adventitious avicularia. Primary orifice with denticulate distal border, frequently obscured by a sinuate peristome. Avicularia adventitious, polymorphic. Ovicell with a median longitudinal fissure, variably developed.

Type species: *Reteporella flabellata* Busk, 1884.

Reteporella graeffei (Kirchenpauer) (Figs 28c,d, 29a)

Retihomera graeffei Kirchenpauer, 1869: 30.

Reteporella graeffei: Harmer, 1934: 573, pl. 35, figs 12-15; pl. 38, figs 13-15; text-figs 25E, 31, 32; Ryland, 1984: 74, figs 38.11, 40.31-34.

DESCRIPTION

Colony forming an irregular, open or shallowly cupped fan; branches narrow, rather flat, irregularly curved or twisted, dividing dichotomously at irregular intervals, remaining free or anastomosing to leave long, narrow fenestrulae between. Autozooids in four to eight alternating longitudinal rows, flat, or only slightly convex, broadly hexagonal, separated by distinct raised sutures in early ontogeny, but boundaries later rather indistinct. Frontal wall smooth, with two to four proximal marginal pores. Primary orifice wider than long, the proximal border shallowly concave between small, rounded condyles; obscured by a tall proximal peristome, with a longitudinal median fissure, broadened basally to form a labial pore; peristomial rim with two or three short processes proximally, and with one long spine on its inner (i.e., axial) lateral margin, and four on its outer lateral margin. In later ontogeny only a single spine persists on each side. All spines segmented, up to 0.3 mm long. Avicularia present on frontal walls of autozooids, polymorphic: most frequently 0.1 mm long, with semi-elliptical rostrum, and the proximal part produced

as a projecting, linguiform process; occasionally larger, with the rostrum acute, and hooked or dentate distally; gigantic avicularia with abruptly hooked rostrum, up to 0.4 mm long, present on some marginal autozooids. Ovicell slightly longer than wide, with an elongate median slit. In later ontogeny the proximal regions of the colony are grossly thickened, peristomes become deeply immersed, and additional avicularia are budded.

DISTRIBUTION

R. graeffei is common in shallow reef environments throughout the tropical western Pacific, from Queensland to Japan; it ranges throughout the Indo-Malayan region and westwards to Sri Lanka and East Africa.

Triphyllozoon Canu & Bassler, 1917

Colony erect, fenestrate, attached by an encrusting base. Fan- or cup-shaped, or with the edges complexly folded to form a squat, three-dimensional bun shape. Autozooids opening on one face only of fenestrate sheet, in alternating series along the branches (trabeculae), which anastomose at regular intervals defining oval fenestrulae. Basal surfaces of colony crossed by thickened sutures. Primary orifice with denticulate rim, obscured by a deep peristome with a longitudinal slit (pseudosinus), often partly closed except for a proximal pseudospiramen, typically with a small peristomial avicularium. Oral spines present. Frontal wall with few, large marginal pores. Avicularia adventitious, polymorphic. Ovicell prominent, with a conspicuous, trilobed frontal suture, and a well developed labellum overhanging the aperture.

Type species: *Retepora monilifera* MacGillivray, 1860.

Triphyllozoon mucronatum (Busk) (Fig. 28a,b)

Retepora mucronata Busk, 1854: 120, pl. 26, figs 6a-e.

Triphyllozoon mucronatum: Harmer, 1934: 620, pl. 35, fig. 35; pl. 40, figs 13-20; text-fig. 42.

Triphyllozoon sp.: Ryland, 1984: 74, fig. 40.36.

DESCRIPTION

Colony developing a low bun shape, up to 30 mm high with a horizontal spread of up to 60 mm, consisting of finely reticulate, deeply lobed folds, anastomosing frequently to form a compact structure. Fenestrulae small, regularly oval, 1.0 × 0.5 mm; trabeculae comprise three to

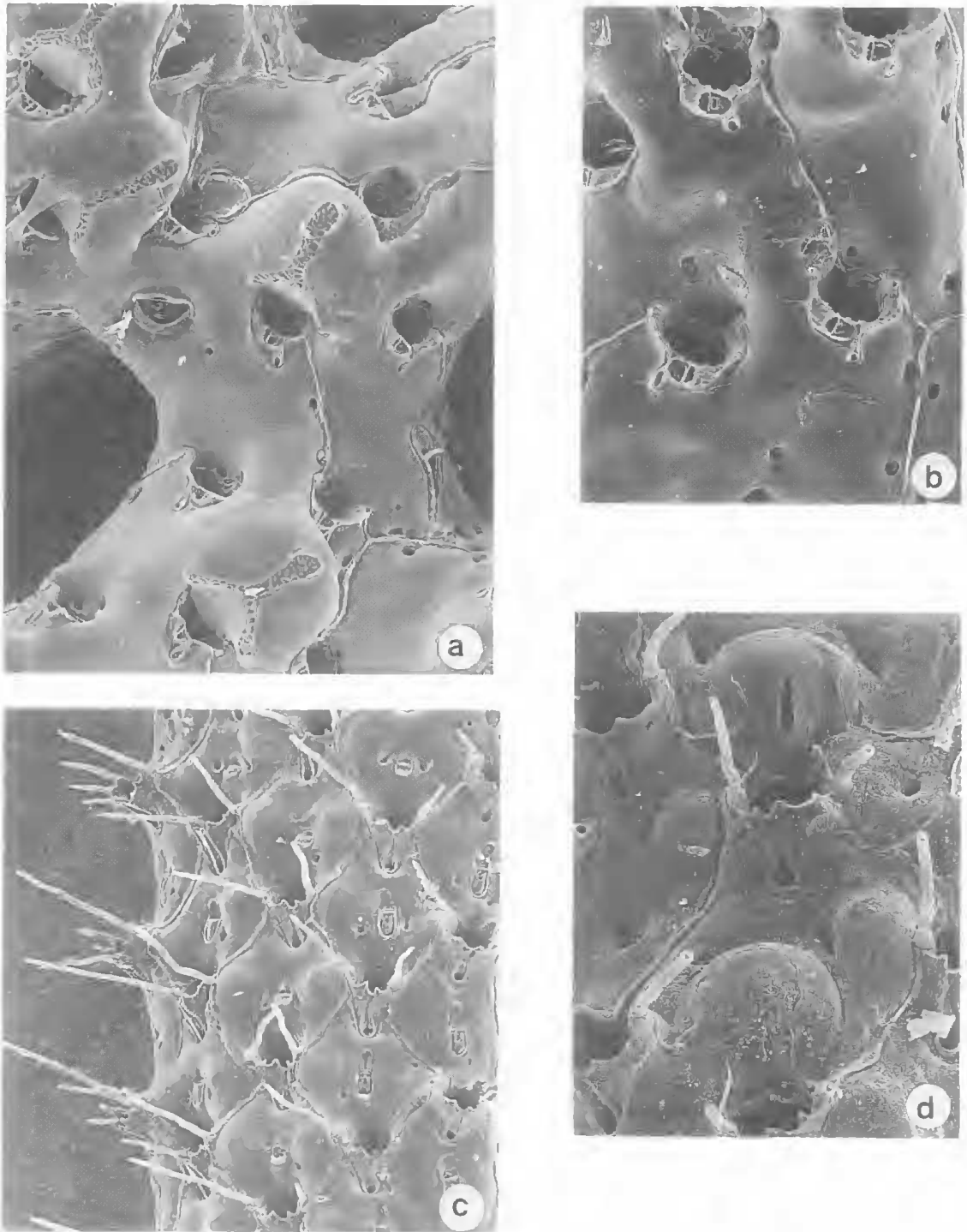


FIG. 28. a,b, *Triphyllozoon mucronatum*; a, $\times 80$; b, $\times 120$. c,d, *Reteporella graeffei*; c, $\times 60$; d, $\times 130$.

five longitudinal autozoid series. Autozooids commonly 0.4×0.2 mm, with smooth, convex frontal wall, bordered by a few large, widely spaced marginal pores; sutures between autozooids distinct at growing edge, later progressively obscured. Primary orifice D-shaped, hidden by a deep peristome enclosing its proximal and lateral borders; lip of peristome reflected, with a series of coarse crenulations on its inner edge; medio-proximally a short fissure connects the peristomial rim with the small labial pore, to one side of this is a small peristomial avicularium, acute to frontal plane, laterally directed, with rounded, finely denticulate rostrum. Four short, distal oral spines present in newly budded autozooids, only the proximal pair persisting in later ontogeny. Frontal adventitious avicularia frequent, rostrum 0.1 mm long, oval or slightly spatulate. A single large vicarious avicularium present distal or proximal to each fenestrula, with a swollen cystid supporting a narrowly crescentic rostrum; other, larger avicularia occur sporadically, typically within each fenestrula an avicularium with a narrow, elongate rostrum, broadened and denticulate distally; elsewhere, elongate triangular avicularia may be present. Ovicell slightly longer than wide, with a short, square-edged labellum; median frontal fissure longer than proximal fissures.

DISTRIBUTION

This species is known from a few localities in the Philippine Islands, northern New Guinea and eastern Indonesia. It has not been identified previously from Australia.

Schedocleidochasma Soule, Soule & Chaney, 1991

Colony encrusting, uni- or multilaminar. Primary orifice of autozoid cleithridiate (keyhole-shaped), with a deep, arrowhead-shaped or transversely oval sinus below prominent condyles; distal rim of orifice smooth. Oral spines present or absent. Frontal wall with few marginal pores. Avicularia adventitious. Ovicell hyperstomial, partly immersed, not closed by autozoid operculum; with a frontal area of uncalcified ectooecium, and a well-marked labellum. Vertical walls with basal or mural pore chambers.

Type species: *Schedocleidochasma porcellaniforme* Soule, Soule & Chaney, 1991.

Schedocleidochasma porcellanum (Busk) (Fig. 27e)

Lepralia porcellana Busk, 1860: 283, pl. 31, fig. 3.

Cleidochasma porcellanum: Harmer, 1957: 1042, pl. 71, figs 5, 16; Cook 1964b: 11, pl. 1, fig. 4; pl. 2, figs 1, 2; text-figs 4A-E; Winston & Heimberg 1986: 34, figs 85-87.

Schedocleidochasma porcellanum: Soule, Soule & Chaney, 1991: 481.

REMARKS

This familiar species has a circumtropical/subtropical distribution in shallow coastal waters, and may be particularly common in reef flat habitats, on coral rubble, or other hard substrata. At Heron Island it forms flat, silvery, unilaminar sheets, often exceeding 3 cm². It is readily recognised by the shape of the primary orifice, the lateral suboral avicularium, and its thick, porcellaneous secondary calcification. It was present in abundance in seven of the Heron Island samples.

The major revision of *Cleidochasma* by Soule et al. (1991) was published after this paper had been submitted for publication. The specimen illustrated here appears to conform to their concept of *S. porcellanum*, especially in its shallow, transversely oval sinus but, in view of the fact that several previous West Pacific records of this species were shown by Soule et al. to represent their new species, *S. porcellaniforme*, it will be necessary subsequently to review the Heron Island material attributed to *S. porcellanum*.

Rhynchozoon Hincks, 1895

Colony encrusting, multilaminar; discoid, domed, or more usually irregularly spreading, extensive, nodular. Autozooids distinct only at growing edges of colony, or in new, frontally budded laminae; elsewhere immersed to a varying degree in thick secondary calcification. Primary orifice with distal border (anterior) beaded or denticulate; proximal border (posterior) broadly concave to narrowly sinuate; condyles usually distinct. Oral spines sometimes present in newly budded autozooids. Orifice encircled, and later partly obscured, by marked peristomial thickening, frequently produced into erect or cylindrical, knob-like processes; typically with a distinct notch (pseudosinus) in the proximal border. A transversely or obliquely laterally orientated avicularium located on the proximo-lateral border of the orifice, large and conspicuous, with hooked rostrum and apical process (umbo), or

small and concealed within peristome; often with a stout process (uncinate process) projecting towards the orifice from the inner, proximal edge of the avicularium. Additional, large or small, avicularia present on frontal wall of autozoid, or around peristome rim, often numerous. Frontal calcification of autozooids thick, frequently pearly or distinctly nodular, with marginal pores only. Ovicell typically elongate oval, with a distinct lip (labellum) above the aperture; frontal surface with the outer layer (ectooecium) uncalcified, exposing a smooth or granular area of entoecium (tabula); most often immersed in thickening calcification in early ontogeny and becoming indistinct. Vertical walls with small basal pore chambers.

Type species: *Lepralia bispinosa* Johnston, 1847.

Species of *Rhynchozoon* are common on all tropical reefs and can be particularly difficult to identify. Ontogenetic thickening of the frontal calcification, accompanied by progressive immersion of the primary orifice, and the proliferation of frontally budded avicularia may completely mask those features important for identification. In practice, it is usually impossible to identify any specimen of *Rhynchozoon* without first bleaching a sample to reveal details of the primary orifice. Size and shape of the primary orifice (in particular the sinus), and the morphology of the proximal suboral avicularium are the most important taxonomic features in this genus. In some species, the frontal avicularium and the ovicell provide useful, confirmatory characters.

***Rhynchozoon ardeolum* sp. nov.**
(Fig. 30d,e)

TYPE MATERIAL

HOLOTYPE: GH5238, Heron Island, Stn 25, 18 Apr 1972.

ETYMOLOGY

Latin, diminutive of *ardea*, a heron.

DESCRIPTION

Colony forming broad, multilaminar patches. Autozooids irregularly oval to polygonal, strongly convex, separated by well-marked sutures; commonly $0.45\text{--}0.5 \times 0.35\text{--}0.4\text{ mm}$. Frontal wall thickly calcified, distinctly corrugated, with a single series of round marginal pores. Primary orifice slightly wider than long, with a short, rounded sinus, bounded by thickened cusps, below blunt, rounded condyles. No oral spines.

Many autozooids bearing a very large lateral oral avicularium, with a swollen cystid occupying much of the frontal wall of the autozoid; rostrum broadest proximally, the distal portion, bearing the mandible, elongate, narrow, curved and rounded at the tip, acute to the frontal plane of the autozoid and directed disto-laterally; total length of rostrum $0.3\text{--}0.35\text{ mm}$. Additional avicularia sparsely developed, shorter than the lateral oral type, with a narrowly triangular rostrum distal to the mandibular condyles. In later ontogeny frontal calcification thickens, the marginal pores become much accentuated, and three or four stout, conical processes develop around the disto-lateral borders of the orifice, which, however, remains distinct, though partially immersed, and never completely hidden. Ovicells not present.

Measurements (means and standard deviations of 20 values, mm): orifice length (incl. sinus) 0.12 ± 0.004 ; width 0.12 ± 0.005 .

REMARKS

This species is readily distinguished from all other presently known species of *Rhynchozoon* by its unusually large lateral oral avicularium, and by its very distinctive primary orifice. It was present in two of the Heron Island samples.

***Rhynchozoon bifurcum* Harmer**
(Fig. 29b-d)

Rhynchozoon bifurcum Harmer, 1957: 1070, pl. 70, figs 6, 13-15.

DESCRIPTION

Colony a multilaminar, mamillate sheet. Autozooids at growing edge oval, convex, separated by shallow grooves; about $0.5 \times 0.3\text{ mm}$. Primary orifice wider than long, about $0.16 \times 0.10\text{ mm}$; proximal border shallowly concave between inconspicuous proximo-lateral condyles; no oral spines. Frontal wall nodular, with closely spaced, conspicuous marginal pores. Lateral suboral avicularium present in all autozooids, prominent, with swollen cystid, and broadly triangular, distally hooked rostrum; proximally, a slender subtriangular uncinat process projects above the primary orifice. A stout mucro developing on avicularium, contributing to the peristomial rim, which develops early in ontogeny, obscuring the avicularium and orifice, and eventually consists of six or seven stout, conical processes more or less evenly spaced around the secondary orifice. Frontal

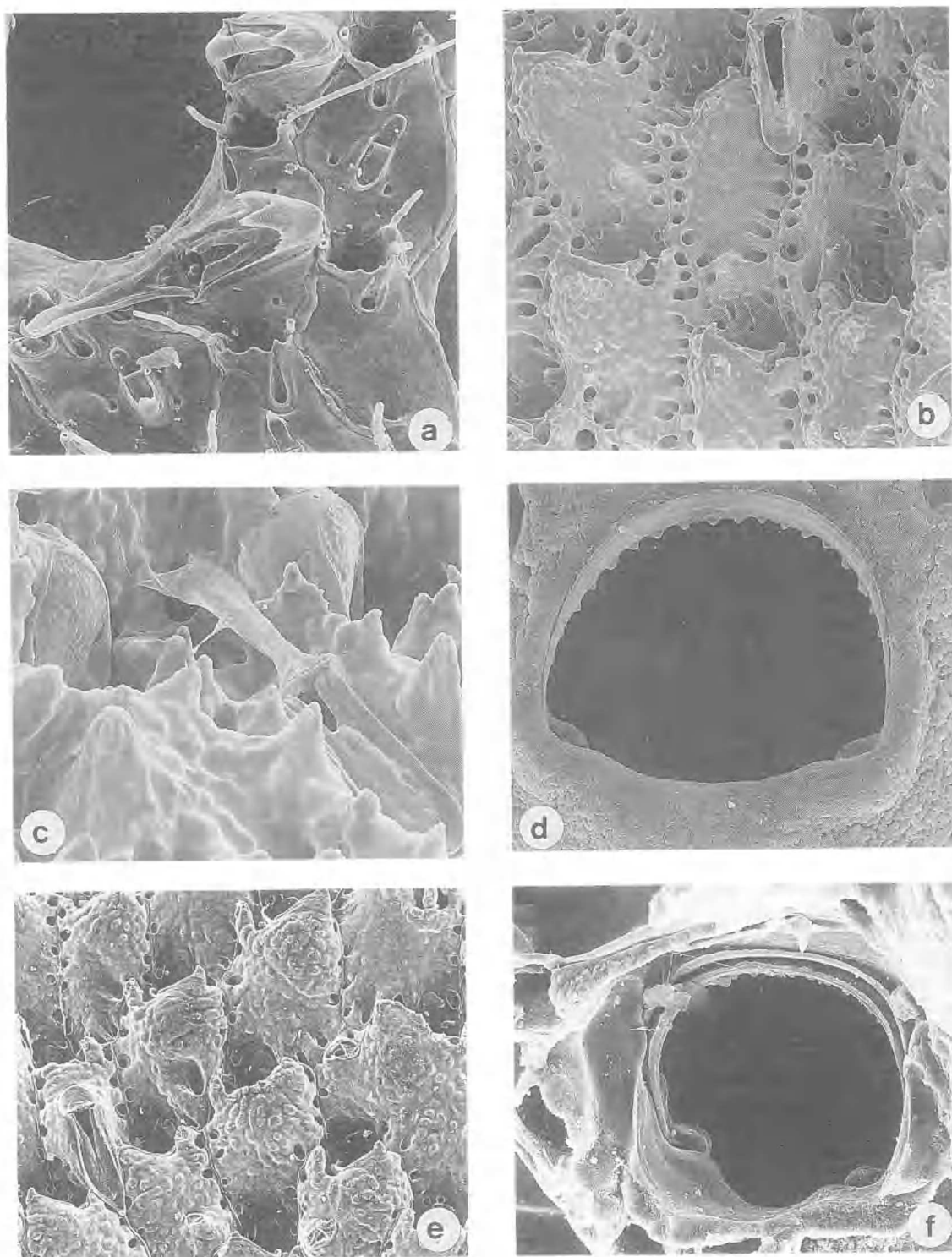


FIG. 29. a, *Reteporella graeffei*, $\times 90$. b-d, *Rhynchozoon bifurcum*; b, $\times 55$; c, an avicularium with bifurcate mandible, $\times 130$; d, primary orifice, $\times 320$. e, f, *Rhynchozoon scopulorum*; e, $\times 50$; f, primary orifice, $\times 270$.

avicularium elongate oval to narrowly spatulate, 0.25-0.5mm long, the mandible in the largest always deeply forked. Ovicell elongate, the frontal surface flat and very finely tuberculate.

DISTRIBUTION

This species is known from Torres Strait, Singapore, and the Chagos Archipelago, but has not been recorded previously from Queensland. The specimen from Japan discussed by Harmer (1957) perhaps does not belong to *R. bifurcun*.

Rhynchozoon compactum (Thornely) (Fig. 30b,c)

Cellepora compacta Thornely, 1905: 126, pl. fig. 17.
Rhynchozoon compactum: Harmer, 1957: 1076, pl. 70, figs 21-25.

DESCRIPTION

Colony forming irregular, multilaminar patches. Autozooids at growing edge oval to hexagonal, strongly convex, smoothly calcified, about $0.5-0.6 \times 0.35$ mm. Primary orifice almost circular, about 0.09mm diameter, with a small, U-shaped sinus. No oral spines. A single, lateral-oral, avicularium present in many, but not all, autozooids, the hooked rostrum perpendicular to the plane of the orifice and proximo-laterally orientated. Ovicell as wide as long, the frontal entooecium smooth, labellum indistinctly curved. In later ontogeny the frontal calcification of the autozooid thickens and becomes faintly corrugated; boundaries between autozooids remain distinct, however, and the few small marginal pores are accentuated. A broad, thick ridge develops around the distal and lateral borders of the primary orifice, characteristically developing two or three knob-like processes, but the orifice remains clearly visible in frontal view. With the development of frontal buds, the primary orifices of the first layer of autozooids become immersed in deep, peristomial tubes, but are not completely hidden. Additional frontal avicularia are sparsely developed, most frequent in later ontogeny; these are up to 0.15mm long, with an elongate oval rostrum.

REMARKS

Heron Island specimens of this distinctive species have been compared with the type material from Sri Lanka, and found to be identical to it. Harmer (1957) listed a specimen from Torres Strait, which it is probably safe to assume belongs to *R. compactum*, but his records from

Japan need to be confirmed following re-examination of the specimens listed.

Rhynchozoon haha Hayward (Figs 30f, 31a,b)

Rhynchozoon haha Hayward, 1988: 334, pl. 11, figs 1,g.

DESCRIPTION

Colony developing broad, irregular, spreading sheets. Autozooids at growing edge oval to hexagonal, or rectangular, convex, separated by distinct sutures; $0.5-0.6 \times 0.3-0.35$ mm. Primary orifice wider than long, with a broad, U-shaped sinus occupying about three-quarters its proximal width; condyles knob-like, small, no oral spines. Frontal wall smooth, with a single series of large, distinct marginal pores. A large, lateral suboral avicularium present on most autozooids; cystid swollen, frequently with a small umbo on its frontal surface; rostrum acute to frontal plane, directed disto-laterally, acuminate but with only a slight distal hook; proximally the avicularian rostrum thickens to form a short, blunt, uncinate process. Frontal adventitious avicularia characteristic: typically one per autozooid, 0.2mm long, directed proximally or proximo-laterally; lozenge-shaped, with the narrowly triangular rostrum about twice as long as the proximal opesia. Ovicell short, smooth frontally, completely immersed by ooecial cover and not readily visible in frontal view. With ontogenetic thickening the primary orifice becomes deeply immersed, hiding the suboral avicularium; four or five stout, conical umbones develop on the peristomial rim, with the proximalmost pair flanking a pronounced proximo-medial notch. The frontal avicularia remain distinct, however, and the autozooid boundaries can be recognised by the deep, conspicuous marginal pores.

DISTRIBUTION

R. haha was founded on material collected from reef habitats around Mauritius (Hayward, 1988). This is only the second occurrence, but it will probably prove to be generally distributed in the Indo-West-Pacific region, in shallow reef habitats.

Rhynchozoon limatulum sp. nov. (Fig. 31c-c)

TYPE MATERIAL

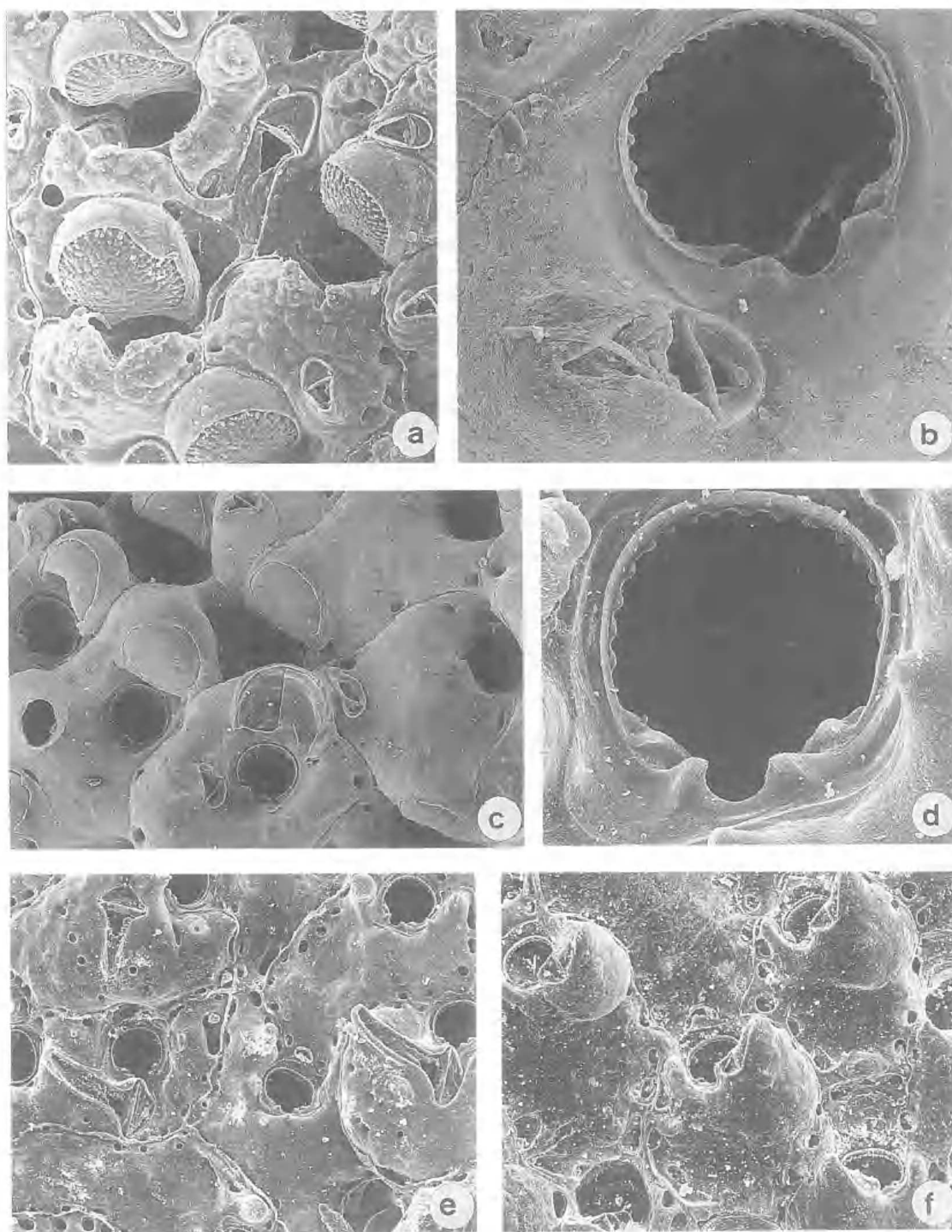


FIG. 30. a, *Rhynchozoon scopulorum*, $\times 70$. b, c, *Rhynchozoon compactum*; b, $\times 350$; c, $\times 80$. d, e, *Rhynchozoon ardeolum*; d, $\times 350$; e, $\times 60$. f, *Rhynchozoon haha*, $\times 70$.

HOLOTYPE: GH5239, Heron Island, Stn 14, 12 Apr 1972.

ETYMOLOGY

Latin, diminutive of *limatus*, polished.

DESCRIPTION

Colony forming irregular, multilaminar sheets. Autozooids at growing edge broadly oval, convex, separated by distinct sutures. Primary orifice distinctly wider than long, with a deep, U-shaped sinus occupying most of proximal width; condyles thickened, conspicuous. No oral spines. Frontal wall smoothly calcified, bordered by small, widely-spaced marginal pores; typically developing two or three prominent, conical processes proximally, forming part of the peristome of the preceding autozoooid. Peristome spinous, typically with a single medio-proximal process, paired lateral processes, and two or three distal processes, all prominent, tapered, and occasionally bifurcate apically. Most autozooids with a lateral oral avicularium enclosed within the peristome, the rostrum slender, triangular, hooked distally, and laterally directed. One to three smaller avicularia present on frontal wall; rostrum slender, triangular, laterally directed. Ovicell with a very short labellum and a conspicuous frontal fenestra; rapidly immersed in a smooth ooecial cover.

Measurements (means and standard deviations of 20 values, mm): autozoooid length 0.41 ± 0.04 ; width 0.30 ± 0.04 ; orifice length 0.08 ± 0.004 ; width 0.10 ± 0.003 .

REMARKS

This species is distinguished from others in the Heron Island reef flat fauna by its short, wide primary orifice, and comparatively deep sinus. The smooth frontal calcification, spinous peristomes and small frontal avicularia are also characteristic.

Rhynchozoon scopulorum sp. nov. (Figs 29e,f,30a)

TYPE MATERIAL

HOLOTYPE: GH5240, Heron Island, Stn 16, 13 Apr 1972.

ETYMOLOGY

Latin *scopulosus*, rocky.

DESCRIPTION

Colony forming broad, spreading sheets.

Autozooids at growing edge oval to hexagonal, convex, separated by distinct sutures. Primary orifice about as wide as long, with shallow, U-shaped sinus occupying about half proximal width; condyles rounded, distinct; distal and disto-lateral denticulations fine, closely spaced. No oral spines. Frontal wall distinctly nodular, with few, widely spaced, marginal pores. Lateral suboral avicularium large and prominent; rostrum acute to frontal plane, laterally directed, hooked distally; proximally, the rostral rim is produced as a stout, conspicuous uncinat process, almost reaching the opposite side of the peristome, delimiting a rounded pseudosinus. A small adventitious avicularium present on the frontal wall of most autozooids, the rostrum triangular, acute to frontal plane, usually directed proximally. Large frontal avicularia sporadic: 0.4mm long, occupying most of autozoooid frontal wall, proximally directed; rostrum lanceolate, often asymmetrical, with upturned tip. Ovicell longer than broad, projecting well above peristomial rim and remaining distinct in later ontogeny; frontal surface slightly flattened, minutely tuberculate. In later ontogeny the suboral avicularium becomes submerged within the peristome, and the proximal peristomial rim bears a pair of short, conical umbones, with a shallow, U-shaped notch between.

Measurements (means and standard deviations, mm): autozoooid length ($n = 20$) 0.56 ± 0.05 ; width 0.33 ± 0.03 ; orifice length ($n = 10$) 0.11 ± 0.005 ; width 0.14 ± 0.000 .

REMARKS

This species is similar to the Indonesian *R. detectum* Harmer, 1957, recently described and figured by Winston & Heimberg (1986). However, *R. detectum* is distinguished from *R. scopulorum* by its primary orifice, which is only very shallowly concave proximally, and by its large frontal avicularia, which are narrower and more distinctly pointed than in *R. scopulorum*. The large avicularia of the latter are in fact almost identical to those of *R. triangulare* Harmer, 1957, also described from Indonesia; the primary orifice of *R. triangulare*, however, has a slit-like proximal sinus. *Rhynchozoon scopulorum* seems to be common at Heron Island; large colonies were present in six of the samples studied.

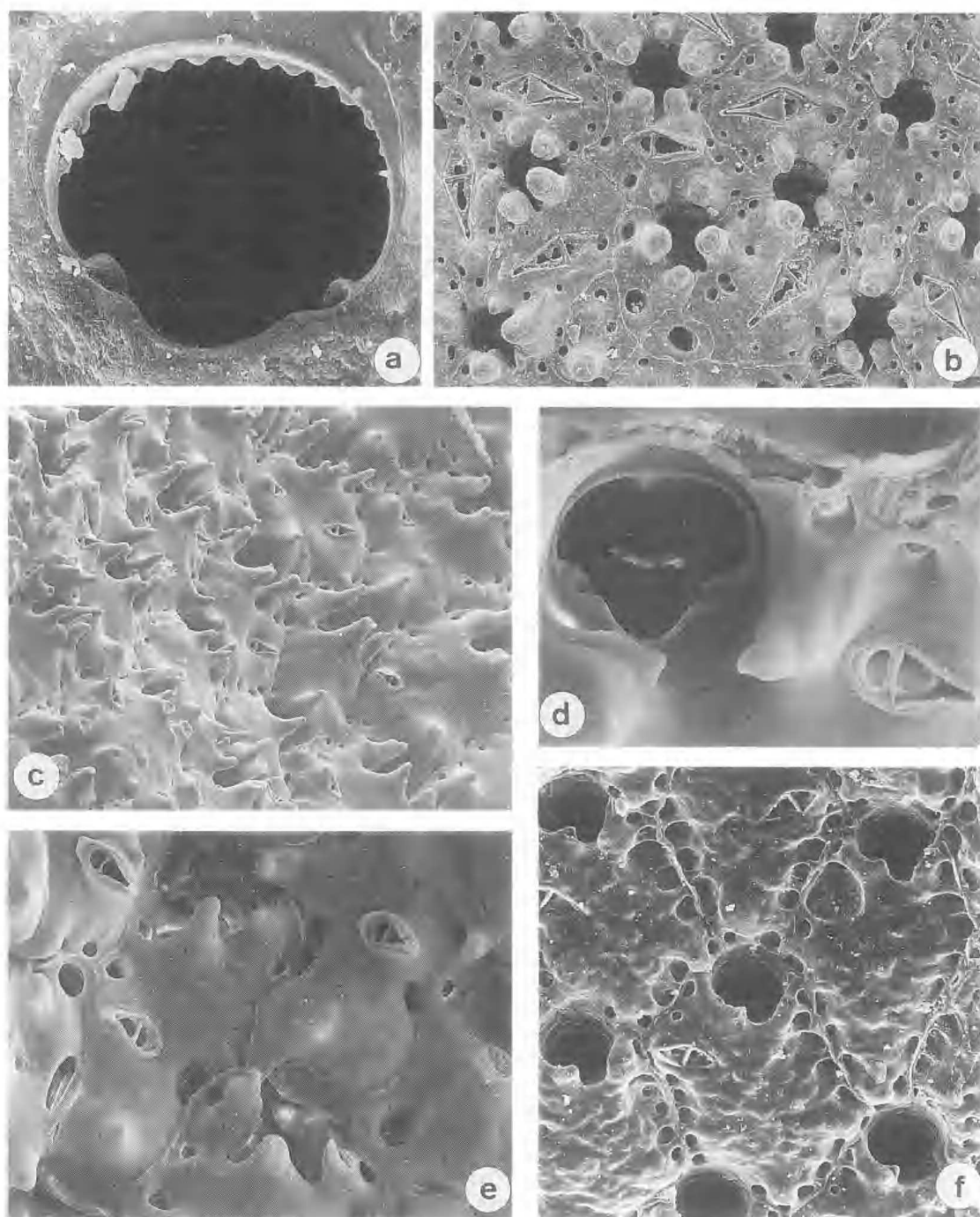


FIG. 31. a,b, *Rhynchozoon haha*; a, $\times 450$; b, $\times 55$. c-e, *Rhynchozoon limatulum*; c, $\times 70$; d, $\times 300$; e, $\times 140$. f, *Rhynchozoon splendens*, $\times 80$.

***Rhynchozoon splendens* Hayward**
(Figs 31f, 32a,b)

Rhynchozoon splendens Hayward, 1988: 335, pl. 13, figs f,g.

Rhynchozoon rostratum: Winston & Heimberg, 1986: 38, figs 95-98.

DESCRIPTION

Colony forming spreading, multilaminar sheets. Autozooids at growing edge oval, convex, separated by distinct grooves; commonly $0.45-0.50 \times 0.3$ mm. Primary orifice 0.12 mm wide, about as long as wide; sinus short, U-shaped, occupying about half proximal width of orifice; condyles indistinct. No oral spines. Frontal wall at first smooth, but becoming coarsely and irregularly nodular; bordered by large and conspicuous marginal pores. Peristomial rim markedly thickened, produced into a series of projecting, knob-like, conical process, the most constant being a medio-proximal pair which may be especially prominent; most autozooids with a single, lateral, suboral avicularium enclosed within the peristome, with triangular, hooked rostrum directed laterally or disto-laterally; the inner proximal corner of the rostral rim is produced as a short, blunt, uncinat process. Small frontal avicularia present, typically one proximo-lateral to peristome, and sometimes a second, more proximally situated; rostrum diamond-shaped, with variable orientation. Ovicell with a short, broad labellum; developing a finely nodular oocell cover, generally rather inconspicuous.

REMARKS

R. splendens was recently described from Mauritius (Hayward, 1988), where it was found to be common in shallow reef habitats. Comparison of Heron Island specimens with Mauritian material confirms that they are all one species; the shape and size of the primary orifice, the conformation of the peristome, and the characteristic diamond-shaped avicularia are all remarkably similar in the two series of specimens. The species reported from Sanur, Bali, by Winston & Heimberg (1986) as *R. rostratum* (Busk) seems to be *R. splendens*. *R. rostratum* is similar to *R. splendens* in its diamond-shaped frontal avicularia and lobed peristome, which encloses a large lateral-suboral avicularium, but differs in its primary orifice, which has a wide, shallow sinus, and proportionately larger condyles. *R. splendens* was the most common species of *Rhynchozoon* collected

at Heron Island; small colonies, and larger sheets, were frequent in eight of the samples described here.

***Rhynchozoon tubulosum* (Hincks)**
(Fig. 32c-e)

Mucronella (?) *tubulosa* Hincks, 1880d: 383, pl. 17, fig. 7.

Mucronella tubulosa: Thornely, 1905: 124.

Rhynchozoon tubulosum: Harmer, 1957: 1064, pl. 65, figs 16-19; Gordon, 1984: 125, pl. 52, figs C-E; Hayward, 1988: 336 [in part; not pl. 14, figs a, b].

DESCRIPTION

Colony forming small, unilaminar patches. Autozooids at growing edge oval to hexagonal, steeply convex, separated by distinct sutures (indistinct in later ontogeny); $0.45-0.5 \times 0.25-0.35$ mm. Primary orifice as wide as long; proximal edge broadly and shallowly concave between small, rounded, proximo-lateral condyles; distal/disto-lateral denticulations small and widely spaced. Frontal wall irregularly nodular, with few, large, widely-spaced marginal pores; proximal peristomial lip prominent, raised medially as a stout, knobby mucro, occasionally spiky, or distinctly bifid apically; additional, shorter mucronate processes sometimes developed lateral to the median. Suboral avicularium transversely orientated, on the inner surface of the mucro, the rostrum sharply hooked distally, but without an associated uncinat process. Large frontal avicularia sporadically present, most frequent in older parts of colony; rostrum linguiform, about 0.35 mm long, normal to frontal plane and proximally directed. Tiny adventitious avicularia, with short triangular mandible, often developed towards tip of mucro, and rarely elsewhere on the frontal wall. Ovicell about as wide as long, slightly flattened frontally, with a finely tuberculate surface, projecting well above rim of peristome.

REMARKS

With ontogenetic frontal wall thickening the primary orifice becomes deeply immersed and the mucronate proximal peristome especially prominent, so that autozooids appear to be vertically orientated. Hinck's (1880d) unfortunately inadequate figure shows a group of autozooids in late ontogeny, with prominent, mucronate peristomes, tuberculate ovicells clearly visible above the peristome rims, and large, linguiform frontal avicularia. No type specimen is known for *R.*

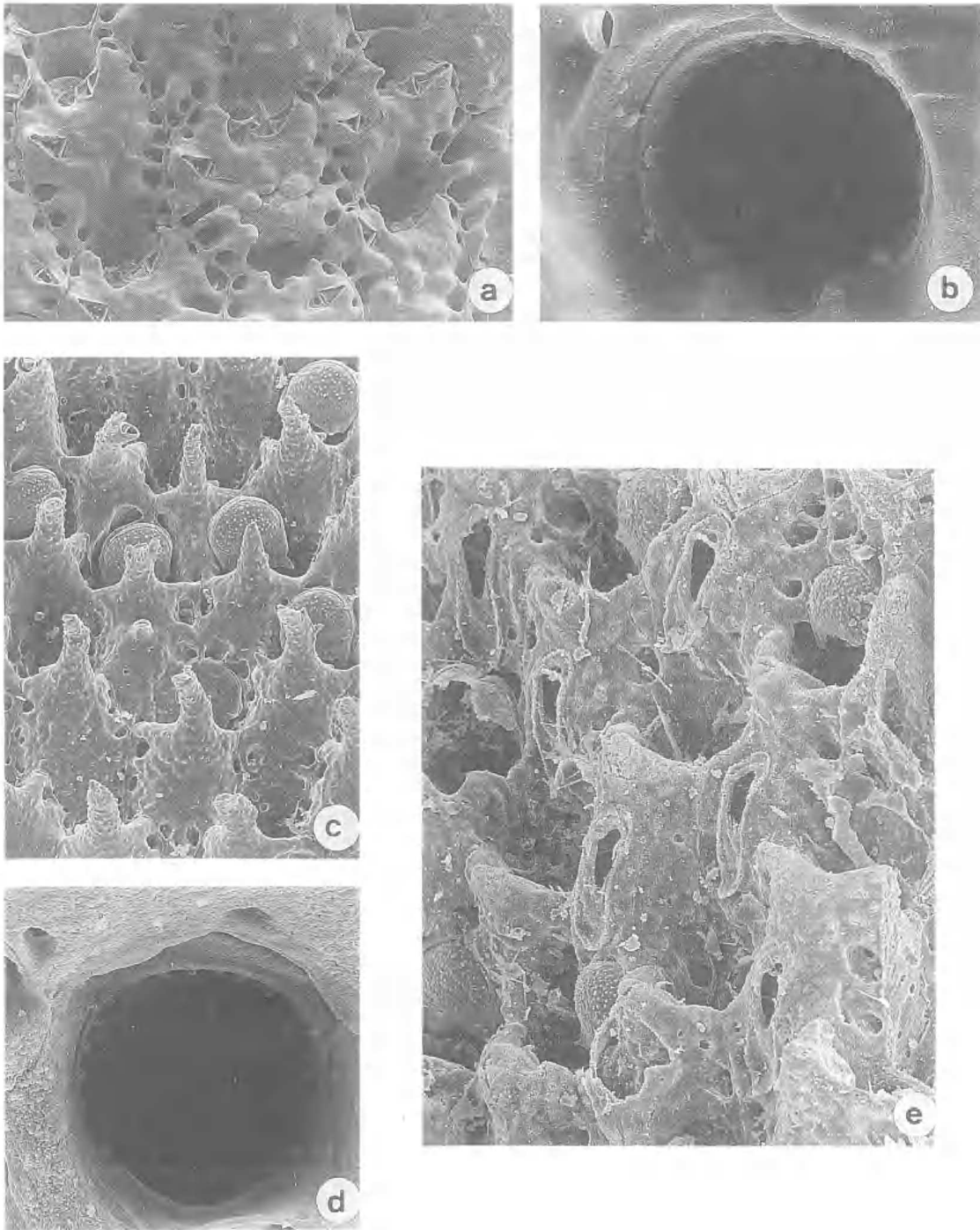


FIG. 32. a,b, *Rhynchozoon splendens*; a, $\times 60$; b, $\times 350$, c-e, *Rhynchozoon tubulosum*; c, $\times 45$; d, $\times 260$; e, $\times 70$.

tubulosum, Hincks' original description is incomplete, and the identity of the Heron Island species described here depends entirely on the resemblance of older autozooids to Hincks' figure. Subsequent authors (see Harmer, 1957: 1064) considered that *Rhynchozoon longirostre* (Hincks), described from southern Australia, was the same as *R. tubulosum*, an assertion which was denied by the author himself (Hincks, 1891). In Hincks' original specimens of *R. longirostre* (e.g., BMNH 1899.5.1.1161, 1163), the suboral avicularium is associated with a massive uncinate process, which partly obscures the primary orifice, a feature not seen in any of the material of *R. tubulosum* examined here. Consequently, the synonymy of the two taxa should be rejected. Thornely's (1905) material of *R. tubulosum* from Sri Lanka (BMNH 1936.12.30.48A) and Harmer's (1957) Indonesian specimens are the same species as that occurring at Heron Island; Harmer's synonymy, however, cannot be accepted until all listed records of *R. tubulosum*, *R. longirostre* and *R. profundum* (MacGillivray) have been re-examined. The material described from Mauritius by Hayward (1988) unfortunately comprised two species, and the specimen figured (Hayward, 1988, pl. 14, figs a,b) is not *R. tubulosum*, but an undescribed species of *Rhynchozoon*.

CONCLUSION

The selection of Bryozoa described in this preliminary account comprises a single cyclostome, and 80 species of cheilostome, encompassing 46 genera in 27 families. Of these 80 species, 14 are new to science and 24 are reported for the first time from Australian seas. The remaining 43 species include at least 25 which are known to be widely distributed in the Indo-West Pacific realm, some of which (e.g., *Chorizopora brongniartii* and *Arthropoma cecilii*) appear to have almost world-wide distributions in shallow tropical and temperate seas. This group of 81 species includes the most abundant, most familiar and taxonomically least problematic members of the bryozoan fauna of the Heron Island reefs. While the range of genera represented gives some indication of the taxonomic diversity of the fauna, the total number of species is likely to be greatly increased as the rest of the collection is studied. It is worth noting that few of the species listed by Livingstone (1927) or described by Hastings (1932) from GBR localities have so far been found in these collections. Unfortunately,

progress in taxonomic research on tropical Australian Bryozoa is hampered by the necessity to review all previous published sources critically, and whenever possible to refer to type and original specimens. Harmer's (1957) fourth Siboga Report, presently the most important of these sources, has serious shortcomings in that the synonymies of many of the species it describes can be shown to be erroneous, while a substantial number of others are founded on material which clearly consists of more than a single species.

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